
CLAIMS

[Claim(s)]
[Claim 1] The weight section arranged in the opening aperture penetrated on the front reverse side of a rectangle frame-like housing is connected with a housing at one through the bending section which has flexibility. And the body of a sensor with which the gage resistance which detects the stress which bends according to an operation of the acceleration to the weight section, and is produced in the section bent, it was prepared in the section, and the electrode for I/O was prepared in the front-face side of a housing, The 1st covering joined to the housing so that said opening aperture might be covered to the front-face side of the body of a sensor, It has the 2nd covering joined to the housing so that said opening aperture might be covered to the rear-face side of the body of a sensor. The bending section The semi-conductor acceleration sensor characterized by being prepared in the front-face side of the body of a sensor, bending so that the both ends of the extended direction may become broader than a center section, and coming to form a chamfer between the both-sides side of the section, the inner skin of a housing, and the peripheral face of the weight section.
[Claim 2] Said gage resistance is a semi-conductor acceleration sensor according to claim 1 characterized by coming to be formed in the part except said both ends in said bending section.
[Claim 3] It is the semi-conductor acceleration sensor according to claim 1 or 2 which is equipped with said two bending sections, is estranged and formed in the direction in which said each bending section meets one side of said weight section, and is characterized by said each bending section coming it larger than the chamfer by the side of the side face which counters mutually in the direction in alignment with said one side to carry out size of the chamfer by the side of a reverse side face.
[Claim 4] Said body of a sensor is a semi-conductor acceleration sensor according to claim 1 to 3 characterized by being formed using the SOI substrate between which the embedded insulating layer was made to be placed between the 1st silicon layer by the side of a rear face, and the 2nd silicon layer by the side of a front face, and said bending section consisting of a part of 2nd silicon layer.
[Claim 5] The front face of said SOI substrate is a semi-conductor acceleration sensor according to claim 4 characterized by consisting of a field (100).
[Claim 6] It is the manufacture approach of a semi-conductor acceleration sensor according to claim 5. The thickness of the part corresponding to the slit formed except for said bending section in a SOI wafer between said weight sections and said housings and said each of bending section is larger than the thickness adding said the 2nd silicon layer and said embedded insulation layer thickness. The 1st etching process which carries out anisotropic etching from the rear face of a SOI wafer using the 1st alkali system solution so that it may become the predetermined thickness set as extent which can prevent breakage of a SOI wafer until said electrode is formed, The 2nd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit and said each of bending section from the rear-face side of a SOI wafer using the 2nd alkali system solution until it reaches said embedded insulating layer after forming said electrode, The 3rd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer, It has the 4th etching process which removes said embedded insulating layer of the part corresponding to said slit and said bending section in a SOI wafer. At said 3rd etching process The manufacture approach of the semi-conductor acceleration sensor characterized by using a wrap mask for the front-face side of a SOI wafer so that opening of the part corresponding to said slit may be carried out and the part corresponding to said bending section, said housing, said weight section, and said chamfer may be protected.
[Claim 7] It is the manufacture approach of a semi-conductor acceleration sensor according to claim 5. The thickness of the part corresponding to the slit formed except for said bending section in a SOI wafer between said weight sections and said housings and said each of bending section is larger than the thickness adding said the 2nd silicon layer and said embedded insulation layer thickness. The 1st etching process which carries out anisotropic etching from the rear face of a SOI wafer using the 1st alkali system solution so that it may become the predetermined thickness set as extent which can prevent breakage of a SOI wafer until said electrode is formed, The 2nd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit and said each of bending section from the rear-face side of a SOI wafer using the 2nd alkali system solution until it reaches said embedded insulating layer after forming said electrode, The 3rd etching process which etches to the middle said embedded insulating layer exposed after the 2nd etching process, The 4th etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer, It has the 5th etching process which removes said embedded insulating layer of the part corresponding to said slit and said bending section in a SOI wafer. At said 4th etching process The manufacture approach of the semi-conductor acceleration sensor characterized by using a wrap mask for the front-face side of a SOI wafer so that opening of the part corresponding to said

slit may be carried out and the part corresponding to said bending section, said housing, said weight section, and said chamfer may be protected.
[Claim 8] It is the manufacture approach of a semi-conductor acceleration sensor according to claim 5. The thickness of the part corresponding to the slit formed except for said bending section in a SOI wafer between said weight sections and said housings and said each of bending section is larger than the thickness adding said the 2nd silicon layer and said embedded insulation layer thickness. The 1st etching process which carries out anisotropic etching from the rear face of a SOI wafer using the 1st alkali system solution so that it may become the predetermined thickness set as extent which can prevent breakage of a SOI wafer until said electrode is formed, The 2nd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit and said each of bending section from the rear-face side of a SOI wafer using the 2nd alkali system solution until it reaches said embedded insulating layer after forming said electrode, The 3rd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer, The 4th etching process which performs isotropic etching of each of said silicon layer from the front flesh-side both sides of a SOI wafer using the mask used at said each etching process, It has the 5th etching process which removes said embedded insulating layer of the part corresponding to said slit and said bending section in a SOI wafer. At said 3rd etching process The manufacture approach of the semi-conductor acceleration sensor characterized by using a wrap mask for the front-face side of a SOI wafer so that opening of the part corresponding to said slit may be carried out and the part corresponding to said bending section, said housing, said weight section, and said chamfer may be protected.
[Claim 9] It is the manufacture approach of a semi-conductor acceleration sensor according to claim 5. The thickness of the part corresponding to the slit formed except for said bending section in a SOI wafer between said weight sections and said housings and said each of bending section is larger than the thickness adding said the 2nd silicon layer and said embedded insulation layer thickness. The 1st etching process which carries out anisotropic etching from the rear face of a SOI wafer using the 1st alkali system solution so that it may become the predetermined thickness set as extent which can prevent breakage of a SOI wafer until said electrode is formed, The 2nd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit and said each of bending section from the rear-face side of a SOI wafer using the 2nd alkali system solution until it reaches said embedded insulating layer after forming said electrode, The 3rd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer, It has the 4th etching process which removes said embedded insulating layer of the part corresponding to said slit and said bending section from the rear-face side of a SOI wafer by dry etching in a SOI wafer. At said 3rd etching process The manufacture approach of the semi-conductor acceleration sensor characterized by using a wrap mask for the front-face side of a SOI wafer so that opening of the part corresponding to said slit may be carried out and the part corresponding to said bending section, said housing, said weight section, and said chamfer may be protected.
[Claim 10] It is the manufacture approach of a semi-conductor acceleration sensor according to claim 5. The thickness of the part corresponding to the slit formed except for said bending section in a SOI wafer between said weight sections and said housings and said each of bending section is larger than the thickness adding said the 2nd silicon layer and said embedded insulation layer thickness. The 1st etching process which carries out anisotropic etching from the rear face of a SOI wafer using the 1st alkali system solution so that it may become the predetermined thickness set as extent which can prevent breakage of a SOI wafer until said electrode is formed, The 2nd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit and said each of bending section from the rear-face side of a SOI wafer using the 2nd alkali system solution until it reaches said embedded insulating layer after forming said electrode, The 3rd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer, The 4th etching process which removes said embedded insulating layer of the part corresponding to said slit and said bending section in a SOI wafer where the front-face side of a SOI wafer is covered in a resist layer, It has the resist clearance process of removing said resist layer. At said 3rd etching process The manufacture approach of the semi-conductor acceleration sensor characterized by using a wrap mask for the front-face side of a SOI wafer so that opening of the part corresponding to said slit may be carried out and the part corresponding to said bending section, said housing, said weight section, and said chamfer may be protected.
[Claim 11] It is the manufacture approach of a semi-conductor acceleration sensor according to claim 5. The thickness of the part corresponding to the slit formed except for said bending section in a SOI wafer between said weight sections and said housings and said each of bending section is larger than the thickness adding said the 2nd silicon layer and said embedded insulation layer thickness. The 1st etching process which carries out anisotropic etching from the rear face of a SOI wafer using the 1st alkali system solution so that it may become the predetermined thickness set as extent which can prevent breakage of a SOI wafer until said electrode is formed, Where the whole surface by the side of the rear face of a SOI wafer is covered in the 1st resist layer after forming said electrode, it sets to a SOI wafer. The 2nd etching process which carries out anisotropic etching of the part corresponding to said slit from the front face of a SOI wafer using the 2nd alkali system solution until it reaches said embedded insulating layer, The 1st resist clearance process which removes the 1st resist layer, Where the front-face side of a SOI wafer is covered in the 2nd resist layer after the 1st resist clearance process, it sets to a SOI wafer. The 3rd etching process which carries out anisotropic etching of the part corresponding to said slit and said bending section from the rear-face side of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer, It has the 2nd resist clearance process which removes the 2nd resist layer, and the 4th etching process which removes said embedded insulating layer of the part corresponding to said slit and said bending section in a SOI wafer after the 2nd resist clearance process. At said 3rd etching process The manufacture approach of the semi-conductor acceleration sensor characterized by using a wrap mask for the front-face side of a SOI wafer so that opening of the part corresponding to said slit may be carried out and the part corresponding to said bending section, said housing, said

weight section, and said chamfer may be protected.
[Claim 12] It is the manufacture approach of the semi-conductor acceleration sensor according to claim 6 to 11 characterized by coming to form the periphery of the part corresponding to said chamfer along with the hypotenuses of a side triangle , such as the virtual right angle 2 which uses the interior angle of 45 degrees of the straight line which connects the ends of the part corresponding to said chamfer , and the straight line corresponding to the side edge of said bending section to make as one basic angle , in said mask .
[Claim 13] it be a manufacture approach of the semi-conductor acceleration sensor according to claim 6 to 11 characterize by come to form the periphery of the part corresponding to said chamfer in the configuration which dented the hypotenuses of a side triangle , such as the virtual right angle 2 which use the interior angle of 45 degrees of the straight line which connect the ends of the part corresponding to said chamfer , and the straight line corresponding to the side edge of said bending section to make as one basic angle , to the top-most vertices side in said mask .
[Claim 14] for the periphery of the part on said mask and corresponding to said chamfer , the hypotenuse of the virtual isosceles triangle which use the interior angle of 45 degrees of the straight line which connect the ends of the part corresponding to said chamfer , and the straight line corresponding to the side edge of said bending section to make as one basic angle be [top-most vertices] the manufacture approach of a semi-conductor acceleration sensor according to claim 6 to 11 that it be characterize by come to be form in the configuration where it swelled to the opposite hand .
[Claim 15] It is the manufacture approach of the semi-conductor acceleration sensor according to claim 6 to 11 characterized by coming to form the periphery of the part corresponding to said chamfer along with the virtual hypotenuse which uses the bigger interior angle of the straight line which connects the ends of the part corresponding to said chamfer , and the straight line corresponding to the side edge of said bending section to make than 45 degrees as one basic angle in said mask .
[Claim 16] It is the manufacture approach of the semi-conductor acceleration sensor according to claim 6 to 11 characterized by coming to form the periphery of the part corresponding to said chamfer in accordance with the periphery of a virtual circle which makes the linear dimension of said bending section a diameter, and touches the part corresponding to the side edge of said bending section in said mask.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the semi-conductor acceleration sensor used for an automobile, the aircraft, home electronics, etc., and its manufacture approach.
[0002]
[Description of the Prior Art] From the former, what detects a mechanical distortion as change of electric resistance as an acceleration sensor, and the thing to detect as change of electrostatic capacity are known, and the semi-conductor acceleration sensor formed using a semi-conductor manufacturing technology as an acceleration sensor which detects a mechanical distortion as change of electric resistance is offered.
[0003] As this kind of a semi-conductor acceleration sensor, as shown, for example in drawing 28 (a), some which have the structure which carried out the laminating of the glass coverings 2 and 3 are in both sides of the thickness direction of the body 1 of a sensor formed in the pars intermedia of the thickness direction using SOI (Silicon On Insulator) substrate 100' which has the embedded insulating layer 102 which consists of silicon oxide. In addition, the substrate with which a front face consists of a field (100) as SOI substrate 100' (100) is used. It is set up in the range whose thickness of n form silicon layer 103 by the side of a front face (a barrier layer is called hereafter) is several micrometers - about 10 micrometers, the thickness of n form silicon layer 102 by the side of a rear face (supporters are called hereafter) is set up by about several 100 micrometers, and the embedded insulating layer 102 is set up by several micrometers or less. Moreover, SOI substrate 100' is constituted by some SOI wafers with which the embedded insulating layer 102 was formed between supporters 101 and a barrier layer 103.
[0004] As shown in drawing 28 , the body 1 of a sensor is equipped with the rectangle frame-like housing 11, and it has the structure connected with the housing 11 at continuation one through the bending section 13 which is thin meat rather than the part of others one side around the weight section 12 while the weight section 12 is arranged in opening aperture 11a formed in the center of a housing 11 in the form penetrated on the front reverse side of the thickness direction. Therefore, it bends around the weight section 12 and the slit 14 is formed between housings 11 except for the section 13. Moreover,

the bending section 13 is estranged in the direction in alignment with one side of the weight section 12, and is formed in two places. Every two gage resistance 15 is formed in each bending section 13 as a distorted sensing element, respectively. Gage resistance 15 is a piezoresistance, and it is connected by the diffusion wiring 17 so that a bridge circuit may be constituted. Moreover, the pad 16 used as each terminal of a bridge circuit is formed in the housing 11.

[0005] Therefore, when the external force (namely, acceleration) containing the component of the thickness direction of the body 1 of a sensor acts, a housing 11 and the weight section 12 will displace relatively [direction / of the body 1 of a sensor / thickness], it will bend as a result, the section 13 will bend, and the resistance of gage resistance 15 will change with the inertia of the weight section 12. That is, the acceleration which acted on the body 1 of a sensor is detectable by detecting the resistance value change of gage resistance 15. As for this body 1 of a sensor, the weight section 12 is combined with the housing 11 through the bending section 13 as a cantilever. In here, although the semi-conductor acceleration sensor of drawing 28 (a) constitutes the so-called cantilever-type semi-conductor acceleration sensor, the doubly-supported beam-type semi-conductor acceleration sensor is also known.

[0006] The laminating of the glass covering 2 is carried out to the rear-face side (underside side of drawing 28 (a)) of the thickness direction of the body 1 of a sensor, and the laminating of the glass covering 3 which forms the space which surrounds the weight section 12 with covering 2 is carried out to the front-face side (top-face side of drawing 28 (a)) of the thickness direction of the body 1 of a sensor. Although it is not necessary to seal the space formed between covering 2 and covering 3 In case the weight section 12 moves relatively to a housing 11, damping force (the so-called air discharge) with air acts to the weight section 12. When too much acceleration (for example, thousands G acceleration) is applied, it constitutes so that it may bend by regulating the movement magnitude of the weight section 12 and breakage of the section 13 may be prevented. In both the coverings 2 and 3, the hollows 2a and 3a for securing the successive range of the weight section 12, respectively are formed in the opposed face with the weight section 12.

[0007] By the way, the above-mentioned pad 16 is connected to the diffusion wiring 17 through the metal wiring 21 and the contact section 20 which silicon nitride 19a is formed on silicon oxide 18a, and the body 1 of a sensor becomes from Ai-Si through the contact section 20 while silicon oxide 18a is formed in the front face of a barrier layer 103.

[0008] In order to join a housing 11 and covering 3, the metal layer 22 for junction which consists of aluminum-Si is formed in the front face of the housing 11 in the body 1 of a sensor. In here, the body 1 of a sensor and each coverings 2 and 3 are joined by anode plate junction.

[0009] Hereafter, it explains briefly, referring to drawing 29 about the manufacture approach of the semi-conductor acceleration sensor of drawing 28 (a). In addition, many bodies 1 of a sensor are formed in the SOI wafer 100 (refer to drawing 29 (a)) explained below, much coverings 3 are formed in the 1st glass substrate, and much coverings 2 are formed in the 2nd glass substrate.

[0010] First, after forming silicon oxide 18a and 18b (refer to drawing 2929 (a)) all over the front face of the SOI wafer 100, and each rear face, sequential formation of a diffused resistor 17 and the gage resistance 15 is carried out, and the silicon nitrides 19a and 19b are formed in the barrier layer 103 of the SOI wafer 100 all over each a front-face [of the SOI wafer 100], and rear-face side after that. Next, in order to make thin the part corresponding to a slit 14 and the bending section 13 compared with other parts in the SOI wafer 100, patterning of silicon nitride 19b and silicon oxide 18b by the side of the rear face of the SOI wafer 100 is carried out. Then, the silicon nitrides 19a and 19b are used as a mask. the SOI wafer 100 -- setting -- a slit 14 and the bending section 13 -- it being alike, respectively, and the thickness of a corresponding part until a pad 16 is formed it was set as extent which can prevent breakage of the SOI wafer 100 -- given thickness (larger than the thickness adding the thickness of the barrier layer 103 of the SOI wafer 100, and the thickness of the embedded insulating layer 102) for example, it is set as about 20 micrometers -- **** -- anisotropic etching of the supporters 101 is carried out from the rear face of the SOI wafer 100 using an alkali system solution like KOH so that it may become. Then, form a pad 16, the metal wiring 21, and the metal layer 22 for junction in the front-face side of the SOI wafer 100, then a photolithography technique is used. The resist layer 31 (refer to drawing 29 R> 9 (a)) by which patterning was carried out in order to form an above-mentioned slit in the front-face side of a SOI wafer is formed. By carrying out dry etching of silicon nitride 19a and silicon oxide 18a by the side of the front face of the SOI wafer 100 by using the resist layer 31 as a mask, the structure shown in drawing 29 (a) is acquired.

[0011] Then, the structure shown in drawing 29 (b) is acquired by etching all of silicon nitride 19b by the side of the rear face of the SOI wafer 100, and the great portion of silicon oxide 18b by the side of a rear face. In addition, the thickness of silicon oxide 18b before this etching is set as about 1 micrometer, and the thickness of silicon oxide 18b after this etching is set as about 1000A.

[0012] Next, the structure shown in drawing 29 (d) is acquired by carrying out anisotropic etching using an alkali system solution like TMAH (tetramethylammonium hydroxide) until it reaches the embedded insulating layer 102 from the front flesh-side both sides of the SOI wafer 100 by using silicon oxide 18b by the side of the resist layer 31 by the side of the front face of the SOI wafer 100, and a rear face as a mask. In here, the thickness of the supporters 101 by the side of a rear face is thick rather than the embedded insulating layer 102 before etching by TMAH compared with the thickness of the barrier layer 103 by the side of a front face from the embedded insulating layer 102 in the part corresponding to a slit 14. when the embedded insulating layer 102 is exposed to the front-face side of the SOI wafer 100 (at the so-called event of carrying out just etching that is, the barrier layer 103 --), the cross-section configuration of slot 14a corresponding to a slit 14 is the configuration of reverse trapezoidal shape as shown in drawing 29 (c). moreover It is formed in a configuration to which width of face becomes large gradually, so that it bends as it bends in the outline top view of the body 1 of a sensor shown in drawing 30 and the flat-surface configuration of silicon nitride 19a in the part corresponding to the section 13 is shown in drawing 31 R> 1 (a), and the ends of the extended direction (longitudinal direction of drawing 31 (a)) of the section 13 are approached. The part corresponding to the bending section 13 in the event (that is, condition of drawing 29 (c)) of just etching of the barrier layer 103 being carried out is shown in drawing 31 (b) and drawing 32 R> 2. The flat-surface configuration of the bending section 13 after etching termination (that is, condition of drawing 29 (d)) has become like

drawing 31 (c). Although it is formed in short so that the both ends of the extended direction of the bending section 13 may become broader than a center section when just etching of the barrier layer 103 is carried out Over etching will be carried out in the front-face side of the SOI wafer 100. At the etching termination event the width of face of the both ends of the extended direction of the bending section 13, and a center section — abbreviation — it becomes the same, and it bends and the include angle with the both-sides side of the section 13, the inner skin of a housing 11, and the peripheral face of the weight section 12 to make has become 90 abbreviation. In addition, in drawing 32 , as for both-sides side 13a of the bending section 13, inner skin 11b of a housing 11, and peripheral face 12b of the weight section 12, all serve as a field (111), and, as for the connected surface 25 between both-sides side 13b of the bending section 13, inner skin 11b of a housing 11, and peripheral face 12b of the weight section 12, all serve as a field (110).
[0013] After acquiring the structure shown in above-mentioned drawing 29 (d), the structure shown in drawing 29 (e) is acquired by etching the part which the embedded insulating layer 102 exposed in the water solution of a fluoric acid system, and forming a slit 14.
[0014] Next, the 1st glass substrate with which much coverings 3 were beforehand formed in the front-face side of the SOI wafer 100 is joined by anode plate junction. Then, by joining the 2nd glass substrate with which much coverings 2 were formed beforehand by anode plate junction, and performing dicing to the rear-face side of the SOI wafer 100 after that The semi-conductor acceleration sensor which consists of coverings 2 and 3 of the body 1 of a sensor and a couple as shown in above-mentioned drawing 28 (a) is obtained.
[0015] By the way, although the body 1 of a sensor in the semi-conductor acceleration sensor shown in drawing 28 (a) is formed using SOI substrate 100', what formed the body of a sensor using the semi-conductor substrate to which epitaxial growth of the n form silicon layer was carried out on p form silicon substrate is proposed by JP,8-18066,A. By the body of a sensor of the semi-conductor acceleration sensor indicated by this official report The thickness of n form silicon layer bends and it is set as about 2 times [of the thickness of the section] thickness. In forming the slit between a housing and the weight section, a mask is prepared in the rear face of a semi-conductor substrate, and it is the rear face (that is,) of a semi-conductor substrate. After performing 1st etching until it reaches n form silicon layer from the rear face of p form silicon substrate, the 2nd etching is terminated to the timing which performs 2nd etching from the front flesh side of a semi-conductor substrate, and the part corresponding to a slit penetrates. Therefore, by this body of a sensor, the bending section of the thickness of one half extent of the thickness of n form silicon layer will be formed.
[0016]
[Problem(s) to be Solved by the Invention] It can consider making the weight of bending as a means for raising sensibility in the semi-conductor acceleration sensor shown in above-mentioned drawing 28 (a), so that the amount of bending of the bending section 13 may become large, and thin-film-izing thickness of the section 13 further, or the weight section 12 increase further. However, when raising sensibility with such a means, it sets to a production process. When performing a washing process and an etching process with a liquid in the case of adsorption of the SOI wafer 100 by the vacuum chuck, In the case of the handling which contains the SOI wafer 100 to the cassette for storage In the cases, such as conveyance of the SOI wafer 100, it becomes easy to damage the bending section 13 by mechanical oscillation or the impact, and yield can fall remarkably or it is possible that contamination, failure, etc. of a manufacturing installation by the fragment of the damaged SOI wafer 100 etc. occur. The impact and oscillation by the vacuum adsorption and conveyance of the metal thin film which constitutes a pad 16, the metal wiring 21, and the metal layer 22 for junction especially in membrane formation equipment, The centrifugal force at the time of spreading at the resist spreading process by the spinner for carrying out patterning of the metal membrane concerned, There is a possibility that the SOI wafer 100 may be damaged by an impact in conveyance processes, such as an impact, an oscillation, the impact by the adsorption and conveyance using a mask aligner at a photolithography process and an oscillation, BEKU of a resist and development, and desiccation, an oscillation, etc. by adsorption or conveyance. then, the time of carrying out anisotropic etching by the above-mentioned manufacture approach using KOH from the rear face of the SOI wafer 100 -- bending -- the section 13 and a slit 14 -- it was alike, respectively and the thickness of a corresponding part is set as above-mentioned predetermined thickness.
[0017] however, by the above-mentioned semi-conductor acceleration sensor In spite of bending using the anisotropic etching using alkali system solutions, such as KOH and TMAH, and forming the section 13 Each include angle of both-sides side 13b of the include angle of both-sides side 13b of the bending section 13 and inner skin 11b of a housing 11 to make and the bending section 13 and peripheral face 12b of the weight section 12 to make is 90 degrees. And it bent, and the configuration of the both ends of the section 13 is unstable, it was easy to generate a crack in the part of the root of the bending section 13, and there was nonconformity that shock resistance exceeding 1000G could not be obtained. In addition, by the semi-conductor acceleration sensor for mount, too much acceleration (thousands G or more acceleration) may be added, breakage of the bending section 13 in the acceleration which is several 1000G must be prevented, and quality must be guaranteed.
[0018] moreover, by the semi-conductor acceleration sensor indicated by JP,8-18066,A Since in forming the slit between a housing and the weight section the 1st etching is terminated near a pn junction interface and the thickness of p form silicon substrate is set as about hundreds of micrometers When the thickness of n form silicon layer was set as several micrometers - about 10 micrometers, there was nonconformity that dispersion in the thickness of the part which bends in the wafer side after the 1st etching termination, and is equivalent to the section will become large, and dispersion in the sensibility for every product will become large as a result.
[0019] And since the thickness of the part which bends at the time of the 1st above-mentioned etching termination, and is equivalent to the section was bent by the manufacture approach of the semi-conductor acceleration sensor indicated by JP,8-18066,A and there was only about 2 times [of the thickness of a request of the section] thickness, possibility that a wafer would be damaged at a next process became high, the yield fell, and there was nonconformity that cost will become high.
[0020] In view of the above-mentioned reason, it succeeds in this invention, and the object is in offering the semi-conductor

acceleration sensor excellent in shock resistance, and its manufacture approach.
[0021]
[Means for Solving the Problem] In order that invention of claim 1 may attain the above-mentioned object, the weight section arranged in the opening aperture penetrated on the front reverse side of a rectangle frame-like housing is connected with a housing at one through the bending section which has flexibility. And the body of a sensor with which the gage resistance which detects the stress which bends according to an operation of the acceleration to the weight section, and is produced in the section bent, it was prepared in the section, and the electrode for I/O was prepared in the front-face side of a housing, The 1st covering joined to the housing so that said opening aperture might be covered to the front-face side of the body of a sensor, It has the 2nd covering joined to the housing so that said opening aperture might be covered to the rear-face side of the body of a sensor. The bending section It is what is characterized by being prepared in the front-face side of the body of a sensor, bending so that the both ends of the extended direction may become broader than a center section, and coming to form a chamfer between the both-sides side of the section, the inner skin of a housing, and the peripheral face of the weight section. Since it bends so that the both ends of the extended direction of the bending section may become broader than a center section, and the chamfer is formed between the both-sides side of the section, the inner skin of a housing, and the peripheral face of the weight section, the shock resistance of the bending section improves and the shock resistance as a semi-conductor acceleration sensor also improves.
[0022] In invention of claim 1, since said gage resistance is formed in the part except said both ends in said bending section, invention of claim 2 can lessen effect of said chamfer to output characteristics.
[0023] Invention of claim 3 is equipped with said two bending sections in invention of claim 1 or claim 2. Since said each bending section is estranged and formed in the direction in alignment with one side of said weight section and said each bending section has made size of the chamfer by the side of a reverse side face larger than the chamfer by the side of the side face which counters mutually in the direction in alignment with said one side It can sway in the direction which the point of said weight section meets the up Norikazu side, or can prevent that stress concentrates in a distorted case, bend to a center line with said weight section parallel to the extended direction of said bending section, and the section breaks.
[0024] In invention of claim 1 thru/or claim 3, said body of a sensor is formed using the SOI substrate which made the insulating layer intervene between the 1st silicon layer by the side of a rear face, and the 2nd silicon layer by the side of a front face, said bending section is characterized by consisting of a part of 2nd silicon layer, and invention of claim 4 is an embodiment.
[0025] In invention of claim 4, invention of claim 5 is characterized by the front face of said SOI substrate consisting of a field (100), and is an embodiment.
[0026] Invention of claim 6 is the manufacture approach of a semi-conductor acceleration sensor according to claim 5. The thickness of the part corresponding to the slit formed except for said bending section in a SOI wafer between said weight sections and said housings and said each of bending section is larger than the thickness adding said the 2nd silicon layer and said embedded insulation layer thickness. The 1st etching process which carries out anisotropic etching from the rear face of a SOI wafer using the 1st alkali system solution so that it may become the predetermined thickness set as extent which can prevent breakage of a SOI wafer until said electrode is formed, The 2nd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit and said each of bending section from the rear-face side of a SOI wafer using the 2nd alkali system solution until it reaches said embedded insulating layer after forming said electrode, The 3rd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer, It has the 4th etching process which removes said embedded insulating layer of the part corresponding to said slit and said bending section in a SOI wafer. At said 3rd etching process It is characterized by using a wrap mask for the front-face side of a SOI wafer so that opening of the part corresponding to said slit may be carried out and the part corresponding to said bending section, said housing, said weight section, and said chamfer may be protected.
[0027] Since according to this manufacture approach it is set as extent which can prevent breakage of a SOI wafer until said electrode is formed in said predetermined thickness Can prevent that a SOI wafer is destroyed in the middle of a production process, yield becomes high, can attain low cost-ization, and by breakage of said bending section being prevented further Since it becomes possible to make thickness of said bending section thin, without worsening yield High sensitivity-ization of a semi-conductor acceleration sensor can be attained. Moreover Until it reaches said embedded insulating layer from a rear-face side beforehand in the part corresponding to said slit in a SOI wafer Since anisotropic etching of the part corresponding to said slit is carried out from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer after carrying out anisotropic etching Since over etching time amount from a just-etching event can be shortened and said chamfer is formed, a shock-proof high semi-conductor acceleration sensor can be offered.
[0028] Invention of claim 7 is the manufacture approach of a semi-conductor acceleration sensor according to claim 5. The thickness of the part corresponding to the slit formed except for said bending section in a SOI wafer between said weight sections and said housings and said each of bending section is larger than the thickness adding said the 2nd silicon layer and said embedded insulation layer thickness. The 1st etching process which carries out anisotropic etching from the rear face of a SOI wafer using the 1st alkali system solution so that it may become the predetermined thickness set as extent which can prevent breakage of a SOI wafer until said electrode is formed, The 2nd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit and said each of bending section from the rear-face side of a SOI wafer using the 2nd alkali system solution until it reaches said embedded insulating layer after forming said electrode, The 3rd etching process which etches to the middle said embedded insulating layer exposed after the 2nd etching process, The 4th etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer, It has the 5th etching process which removes said embedded insulating layer of the part corresponding to said slit and said bending section in a SOI wafer. At said 4th etching process It is characterized by using a wrap mask for the front-face side of a SOI

wafer so that opening of the part corresponding to said slit may be carried out and the part corresponding to said bending section, said housing, said weight section, and said chamfer may be protected.
[0029] Since according to this manufacture approach it is set as extent which can prevent breakage of a SOI wafer until said electrode is formed in said predetermined thickness Can prevent that a SOI wafer is destroyed in the middle of a production process, yield becomes high, can attain low cost-ization, and by breakage of said bending section being prevented further Since it becomes possible to make thickness of said bending section thin, without worsening yield High sensitivity-ization of a semi-conductor acceleration sensor can be attained. Moreover In a SOI wafer, beforehand the part corresponding to said slit from a rear-face side to the middle of said embedded insulating layer Since anisotropic etching of the part corresponding to said slit is carried out from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer after etching Since over etching time amount from a just-etching event can be shortened and said chamfer is formed, a shock-proof high semi-conductor acceleration sensor can be offered.
[0030] Invention of claim 8 is the manufacture approach of a semi-conductor acceleration sensor according to claim 5. The thickness of the part corresponding to the slit formed except for said bending section in a SOI wafer between said weight sections and said housings and said each of bending section is larger than the thickness adding said the 2nd silicon layer and said embedded insulation layer thickness. The 1st etching process which carries out anisotropic etching from the rear face of a SOI wafer using the 1st alkali system solution so that it may become the predetermined thickness set as extent which can prevent breakage of a SOI wafer until said electrode is formed, The 2nd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit and said each of bending section from the rear-face side of a SOI wafer using the 2nd alkali system solution until it reaches said embedded insulating layer after forming said electrode, The 3rd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer, The 4th etching process which performs isotropic etching of each of said silicon layer from the front flesh-side both sides of a SOI wafer using the mask used at said each etching process, It has the 5th etching process which removes said embedded insulating layer of the part corresponding to said slit and said bending section in a SOI wafer. At said 3rd etching process It is characterized by using a wrap mask for the front-face side of a SOI wafer so that opening of the part corresponding to said slit may be carried out and the part corresponding to said bending section, said housing, said weight section, and said chamfer may be protected.
[0031] Since according to this manufacture approach it is set as extent which can prevent breakage of a SOI wafer until said electrode is formed in said predetermined thickness Can prevent that a SOI wafer is destroyed in the middle of a production process, yield becomes high, can attain low cost-ization, and by breakage of said bending section being prevented further Since it becomes possible to make thickness of said bending section thin, without worsening yield Can attain high sensitivity-ization of a semi-conductor acceleration sensor, and moreover, since it has the 4th etching process which performs isotropic etching of each of said silicon layer from the front flesh-side both sides of a SOI wafer The stress concentrated on a boundary part with said embedded insulating layer and said housing, and said weight section in the middle of a production process can be eased, and breakage of a SOI wafer can be prevented. Moreover, Until it reaches said embedded insulating layer from a rear-face side beforehand in the part corresponding to said slit in a SOI wafer Since anisotropic etching of the part corresponding to said slit is carried out from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer after carrying out anisotropic etching Since over etching time amount from a just-etching event can be shortened and said chamfer is formed, a shock-proof high semi-conductor acceleration sensor can be offered.
[0032] Invention of claim 9 is the manufacture approach of a semi-conductor acceleration sensor according to claim 5. The thickness of the part corresponding to the slit formed except for said bending section in a SOI wafer between said weight sections and said housings and said each of bending section is larger than the thickness adding said the 2nd silicon layer and said embedded insulation layer thickness. The 1st etching process which carries out anisotropic etching from the rear face of a SOI wafer using the 1st alkali system solution so that it may become the predetermined thickness set as extent which can prevent breakage of a SOI wafer until said electrode is formed, The 2nd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit and said each of bending section from the rear-face side of a SOI wafer using the 2nd alkali system solution until it reaches said embedded insulating layer after forming said electrode, The 3rd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer, It has the 4th etching process which removes said embedded insulating layer of the part corresponding to said slit and said bending section from the rear-face side of a SOI wafer by dry etching in a SOI wafer. At said 3rd etching process, it is characterized by using a wrap mask for the front-face side of a SOI wafer so that opening of the part corresponding to said slit may be carried out and the part corresponding to said bending section, said housing, said weight section, and said chamfer may be protected.
[0033] Since according to this manufacture approach it is set as extent which can prevent breakage of a SOI wafer until said electrode is formed in said predetermined thickness Can prevent that a SOI wafer is destroyed in the middle of a production process, yield becomes high, can attain low cost-ization, and by breakage of said bending section being prevented further Since it becomes possible to make thickness of said bending section thin, without worsening yield High sensitivity-ization of a semi-conductor acceleration sensor can be attained. Moreover Until it reaches said embedded insulating layer from a rear-face side beforehand in the part corresponding to said slit in a SOI wafer Since anisotropic etching of the part corresponding to said slit is carried out from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer after carrying out anisotropic etching Since over etching time amount from a just-etching event can be shortened and said chamfer is formed, a shock-proof high semi-conductor acceleration sensor can be offered. Moreover, since dry etching has removed said embedded insulating layer of the part corresponding to said slit and said bending section from the rear-face side of a SOI wafer in a SOI wafer, said embedded insulating layer can be removed,

without giving an etching damage to the front-face side of a SOI wafer.
[0034] Invention of claim 10 is the manufacture approach of a semi-conductor acceleration sensor according to claim 5. The thickness of the part corresponding to the slit formed except for said bending section in a SOI wafer between said weight sections and said housings and said each of bending section is larger than the thickness adding said the 2nd silicon layer and said embedded insulation layer thickness. The 1st etching process which carries out anisotropic etching from the rear face of a SOI wafer using the 1st alkali system solution so that it may become the predetermined thickness set as extent which can prevent breakage of a SOI wafer until said electrode is formed, The 2nd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit and said each of bending section from the rear-face side of a SOI wafer using the 2nd alkali system solution until it reaches said embedded insulating layer after forming said electrode, The 3rd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer, The 4th etching process which removes said embedded insulating layer of the part corresponding to said slit and said bending section in a SOI wafer where the front-face side of a SOI wafer is covered in a resist layer, It has the resist clearance process of removing said resist layer. At said 3rd etching process It is characterized by using a wrap mask for the front-face side of a SOI wafer so that opening of the part corresponding to said slit may be carried out and the part corresponding to said bending section, said housing, said weight section, and said chamfer may be protected.
[0035] Since according to this manufacture approach it is set as extent which can prevent breakage of a SOI wafer until said electrode is formed in said predetermined thickness Can prevent that a SOI wafer is destroyed in the middle of a production process, yield becomes high, can attain low cost-ization, and by breakage of said bending section being prevented further Since it becomes possible to make thickness of said bending section thin, without worsening yield High sensitivity-ization of a semi-conductor acceleration sensor can be attained. Moreover Until it reaches said embedded insulating layer from a rear-face side beforehand in the part corresponding to said slit in a SOI wafer Since anisotropic etching of the part corresponding to said slit is carried out from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer after carrying out anisotropic etching Since over etching time amount from a just-etching event can be shortened and said chamfer is formed, a shock-proof high semi-conductor acceleration sensor can be offered. Moreover, since said embedded insulating layer of the part corresponding to said slit and said bending section is removed in a SOI wafer where the front-face side of a SOI wafer is covered in a resist layer, in case said embedded insulating layer is removed, the front-face side of a SOI wafer can be protected.
[0036] Invention of claim 11 is the manufacture approach of a semi-conductor acceleration sensor according to claim 5. The thickness of the part corresponding to the slit formed except for said bending section in a SOI wafer between said weight sections and said housings and said each of bending section is larger than the thickness adding said the 2nd silicon layer and said embedded insulation layer thickness. The 1st etching process which carries out anisotropic etching from the rear face of a SOI wafer using the 1st alkali system solution so that it may become the predetermined thickness set as extent which can prevent breakage of a SOI wafer until said electrode is formed, Where the whole surface by the side of the rear face of a SOI wafer is covered in the 1st resist layer after forming said electrode, it sets to a SOI wafer. The 2nd etching process which carries out anisotropic etching of the part corresponding to said slit from the front face of a SOI wafer using the 2nd alkali system solution until it reaches said embedded insulating layer, The 1st resist clearance process which removes the 1st resist layer, Where the front-face side of a SOI wafer is covered in the 2nd resist layer after the 1st resist clearance process, it sets to a SOI wafer. The 3rd etching process which carries out anisotropic etching of the part corresponding to said slit and said bending section from the rear-face side of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer, It has the 2nd resist clearance process which removes the 2nd resist layer, and the 4th etching process which removes said embedded insulating layer of the part corresponding to said slit and said bending section in a SOI wafer after the 2nd resist clearance process. At said 3rd etching process, it is characterized by using a wrap mask for the front-face side of a SOI wafer so that opening of the part corresponding to said slit may be carried out and the part corresponding to said bending section, said housing, said weight section, and said chamfer may be protected.
[0037] Since according to this manufacture approach it is set as extent which can prevent breakage of a SOI wafer until said electrode is formed in said predetermined thickness Can prevent that a SOI wafer is destroyed in the middle of a production process, yield becomes high, can attain low cost-ization, and by breakage of said bending section being prevented further Since it becomes possible to make thickness of said bending section thin, without worsening yield High sensitivity-ization of a semi-conductor acceleration sensor can be attained. Moreover Where the whole surface by the side of the rear face of a SOI wafer is covered in the 1st resist layer, since anisotropic etching of the part corresponding to said slit is carried out from the front face of a SOI wafer using the 2nd alkali system solution until it reaches said embedded insulating layer Since over etching time amount from a just-etching event can be shortened and said chamfer is formed, a shock-proof high semi-conductor acceleration sensor can be offered.
[0038] Invention of claim 12 is characterized by coming to form the periphery of the part on said mask and corresponding to said chamfer along with the hypotenuse of the virtual right-angle 2 equilateral triangle which uses the interior angle of 45 degrees of the straight line which connects the ends of the part corresponding to said chamfer, and the straight line corresponding to the side edge of said bending section to make as one basic angle in invention of claim 6 thru/or claim 11, and it is an embodiment.
[0039] Invention of claim 13 the periphery of the part corresponding to said chamfer in said mask in invention of claim 6 thru/or claim 11 It is characterized by coming to be formed in the configuration which dented the hypotenuse of the virtual right-angle 2 equilateral triangle which uses the interior angle of 45 degrees of the straight line which connects the ends of the part corresponding to said chamfer, and the straight line corresponding to the side edge of said bending section to make as one basic angle to the top-most-vertices side, and is an embodiment.
[0040] Invention of claim 14 the periphery of the part corresponding to said chamfer in said mask in invention of claim 6 thru/or claim 11 The hypotenuse of the virtual isosceles triangle which uses the interior angle of 45 degrees of the straight

line which connects the ends of the part corresponding to said chamfer, and the straight line corresponding to the side edge of said bending section to make as one basic angle is characterized by coming to form top-most vertices in the configuration which swelled to the opposite hand, and it is an embodiment.
[0041] Invention of claim 15 is characterized by coming to form the periphery of the part on said mask and corresponding to said chamfer along with the virtual hypotenuse which uses the bigger interior angle of the straight line which connects the ends of the part corresponding to said chamfer, and the straight line corresponding to the side edge of said bending section to make than 45 degrees as one basic angle in invention of claim 6 thru/or claim 11, and it is an embodiment.
[0042] It is characterized by coming to be formed in accordance with the periphery of a virtual circle to which the periphery of the part corresponding to said chamfer makes the linear dimension of said bending section a diameter, and touches the part corresponding to the side edge of said bending section, and is [in / on invention of claim 6 thru/or claim 11, and / in invention of claim 16 / said mask] an embodiment.
[0043]
[Embodiment of the Invention] (Operation gestalt 1) the basic configuration of the semi-conductor acceleration sensor of this operation gestalt — the former — a configuration and abbreviation — as it is the same and is shown in drawing 1 (a), some which have the structure which carried out the laminating of the glass coverings 2 and 3 are in both sides of the thickness direction of the body 1 of a sensor formed in the pars intermedia of the thickness direction using SOI substrate 100' which has the embedded insulating layer 102 which consists of silicon oxide. In addition, the substrate with which a front face consists of a field (100) as SOI substrate 100' (100) is used. It is set up in the range whose thickness of n form silicon layer 103 by the side of a front face (a barrier layer is called hereafter) is several micrometers - about 10 micrometers, the thickness of n form silicon layer 101 by the side of a rear face (supporters are called hereafter) is set up by about several 100 micrometers, and the embedded insulating layer 102 is set up by several micrometers or less. Moreover, supporters 101 constitute the 1st silicon layer and the barrier layer 103 constitutes the 2nd silicon layer from this operation gestalt.
[0044] As shown in drawing 1 , the body 1 of a sensor is equipped with the rectangle frame-like housing 11, and it has the structure connected with the housing 11 at continuation one through the bending section 13 which is thin meat rather than the part of others one side around the weight section 12 while the weight section 12 is arranged in opening aperture 11a formed in the center of a housing 11 in the form penetrated on the front reverse side of the thickness direction. Therefore, it bends around the weight section 12 and the slit 14 is formed between housings 11 except for the section 13. Moreover, the bending section 13 is estranged in the direction in alignment with one side of the weight section 12, and is formed in two places. Every two gage resistance 15 is formed in each bending section 13 as a distorted sensing element, respectively. Gage resistance 15 is a piezoresistance, and it is connected by the diffusion wiring 17 so that a bridge circuit may be constituted. Moreover, the pad 16 used as each terminal of a bridge circuit is formed in the housing 11. In addition, the electric conduction form of the barrier layer 103 of above-mentioned SOI substrate 100' is an n form, gage resistance 15 and the diffusion wiring 17 are formed by introducing p form impurity into the front-face side of a barrier layer 103, and the high impurity concentration of about three 1018-/cm and the diffusion wiring 17 is set as about three 1020-/cm for the high impurity concentration of gage resistance 15. Moreover, the pad 16 constitutes the electrode from this operation gestalt.
[0045] Therefore, when the external force (namely, acceleration) containing the component of the thickness direction of the body 1 of a sensor acts, a housing 11 and the weight section 12 will displace relatively [direction / of the body 1 of a sensor / thickness], it will bend as a result, the section 13 will bend, and the resistance of gage resistance 15 will change with the inertia of the weight section 12. That is, the acceleration which acted on the body 1 of a sensor is detectable by detecting the resistance value change of gage resistance 15. As for this body 1 of a sensor, the weight section 12 is combined with the housing 11 through the bending section 13 as a cantilever. In here, although the semi-conductor acceleration sensor of drawing 1 (a) constitutes the so-called cantilever-type semi-conductor acceleration sensor, the technical thought of this invention is applicable also to a doubly-supported beam-type semi-conductor acceleration sensor.
[0046] The laminating of the glass covering 2 is carried out to the rear-face side (underside side of drawing 1 (a)) of the thickness direction of the body 1 of a sensor, and the laminating of the glass covering 3 which forms the space which surrounds the weight section 12 with covering 2 is carried out to the front-face side (top-face side of drawing 1 (a)) of the thickness direction of the body 1 of a sensor. Although it is not necessary to seal the space formed between covering 2 and covering 3 In case the weight section 12 moves relatively to a housing 11, damping force (the so-called air discharge) with air acts to the weight section 12. When too much acceleration (for example, thousands G acceleration) is applied, it constitutes so that it may bend by regulating the movement magnitude of the weight section 12 and breakage of the section 13 may be prevented. In both the coverings 2 and 3, the hollows 2a and 3a for securing the successive range of the weight section 12, respectively are formed in the opposed face with the weight section 12.
[0047] By the way, the above-mentioned pad 16 is connected to the diffusion wiring 17 through the metal wiring 21 and the contact section 20 which silicon nitride 19a is formed on silicon oxide 18a, and the body 1 of a sensor becomes from Ai-Si through the contact section 20 while silicon oxide 18a is formed in the front face of a barrier layer 103.
[0048] In order to join a housing 11 and covering 3, the metal layer 22 for junction which consists of aluminum-Si is formed in the front face of the housing 11 in the body 1 of a sensor. In here, the body 1 of a sensor and each coverings 2 and 3 are joined by anode plate junction.
[0049] The same by the way, the thickness of the bending section 13 in the semi-conductor acceleration sensor of this operation gestalt -- the thickness of a barrier layer 103, and abbreviation -- the bending section 13 As it is prepared in the front-face side of the body 1 of a sensor and is shown in drawing 1 - drawing 4 Bend so that the both ends of the extended direction (longitudinal direction in drawing 1 (b)) may become broader than a center section, and the chamfer 26 is formed between both-sides side 13b of the section 13, inner skin 11b of a housing 11, and peripheral face 12b of the weight section 12. Gage resistance 15 is formed in the part except the above-mentioned both ends. In here, as for both-sides side 13a of the bending section 13, inner skin 11b of a housing 11, and peripheral face 12b of the weight section 12, all are formed along

the field (111), and, as for the chamfer 26 between both-sides side 13b of the bending section 13, inner skin 11b of a housing 11, and peripheral face 12b of the weight section 12, all are formed along the field (110).

[0050] A deer is carried out. By the semi-conductor acceleration sensor of this operation gestalt Since it bends so that the both ends of the extended direction (longitudinal direction of drawing 1 (b)) of the bending section 13 in the body 1 of a sensor may become broader than a center section, and the chamfer 26 is formed between both-sides side 13b of the section 13, inner skin 11b of a housing 11, and peripheral face 12b of the weight section 12 It bends compared with the conventional semi-conductor acceleration sensor shown in drawing 28 (a), the shock resistance of the section 13 improves, and the shock resistance as a semi-conductor acceleration sensor also improves. In addition, by the semi-conductor acceleration sensor of this operation gestalt, the shock resistance of 5000G was able to be obtained to only about [1000G] shock resistance having been conventionally obtained by the semi-conductor acceleration sensor of a configuration.

[0051] Moreover, by forming the chamfer 26 between both-sides side 13b of the bending section 13, inner skin 11b of a housing 11, and peripheral face 12b of the weight section 12 Although the stress by bending of the bending section 13 will be applied to an ununiformity at gage resistance 15 and output characteristics will worsen if it bends and gage resistance 15 is formed ranging over the pars intermedia and edge of the section 13 With this operation gestalt, since gage resistance 15 bends and it is formed in the part except the above-mentioned both ends in the section 13, effect of the chamfer 26 to output characteristics can be lessened.

[0052] Hereafter, it explains, referring to drawing 5 - drawing 10 about the manufacture approach of the semi-conductor acceleration sensor of this operation gestalt. In addition, many bodies 1 of a sensor are formed in the SOI wafer 100 explained below, much coverings 3 are formed in the 1st glass substrate 300, and much coverings 2 are formed in the 2nd glass substrate 200.

[0053] First, form silicon oxide 18a and 18b all over the front face of the SOI wafer 100, and each rear face, and a photolithography technique is used after that. The resist layer (not shown) by which patterning was carried out in order to form the diffusion wiring 17 on silicon oxide 18a by the side of the front face of the SOI wafer 100 is formed. The diffusion wiring 17 is formed in the barrier layer 103 of the SOI wafer 100, and the structure shown in drawing 5 (a) is acquired by removing the above-mentioned resist layer. In here, the high impurity concentration of the diffusion wiring 17 is set as about three 1020-/cm as mentioned above, and in formation of the diffusion wiring 17, after it performs pre deposition of p form impurity (for example, boron) to the front face of a barrier layer 101 by the ion implantation, it performs a drive-in. In addition, pre deposition is performed at about 1000 degrees C, and a drive-in is performed on about 1100-degree C temperature conditions.

[0054] Next, in order to form gage resistance 15 on silicon oxide 18a by the side of the front face of the SOI wafer 100, the structure shown in drawing 5 (b) is acquired by forming the resist layer 41 by which patterning was carried out. In addition, the resist layer is formed of the photoresist of a negative mold.

[0055] After forming the above-mentioned resist layer 41 and etching silicon oxide 18a by using the resist layer 41 as a mask, the structure shown in drawing 5 (c) is acquired by forming gage resistance 15 by the ion implantation, and removing the resist layer 41 after that, then forming the silicon nitrides 19a and 19b all over each a front-face [of the SOI wafer 100], and rear-face side. In addition, the high impurity concentration of gage resistance 15 is set as about three 1018-/cm as mentioned above. Moreover, the thickness of a silicon nitride is set up in 1000-2000A.

[0056] Next, while forming the resist layer 42 all over the front-face side of the SOI wafer 100, in order to form the weight section 12 in a rear-face side, the structure shown in drawing 5 (d) is acquired by forming the resist layer 43 by which patterning was carried out. In addition, the resist layers 42 and 43 are formed of the photoresist of a negative mold.

[0057] Then, by carrying out dry etching of the silicon nitride 19b by the side of the rear face of the SOI wafer 100 by using the resist layer 43 as a mask, the structure shown in drawing 6 (a) is acquired, and the structure shown in drawing 6 (b) is acquired by carrying out wet etching of the silicon oxide 18b by the side of the rear face of the SOI wafer 100 by using the resist layers 42 and 43 as a mask further in a fluoric acid system water solution (for example, BHF: fluoric acid water solution containing ammonium fluoride).

[0058] Next, after removing the resist layers 42 and 43, silicon nitride 19b by the side of the rear face of the SOI wafer 100 is used as a mask. the SOI wafer 100 -- setting -- a slit 14 and the bending section 13 -- it being alike, respectively, and the thickness of a corresponding part until a pad 16 is formed it was set as extent which can prevent breakage of the SOI wafer 100 -- given thickness (larger than the thickness adding the thickness of the barrier layer 103 of the SOI wafer 100, and the thickness of the embedded insulating layer 102) for example, it is set as about 20 micrometers -- **** -- the structure shown in drawing 6 (c) is acquired by carrying out anisotropic etching from the rear face of the SOI wafer 100 using an alkali system solution (for example, mixed liquor of KOH and alcohol) so that it may become. That is, in the SOI wafer 100, it is bent by the condition of drawing 6 (c), and the part corresponding to the section 13 is thicker than the thickness of the final bending section 13 in it.

[0059] Then, in order to form the below-mentioned contact hole 45 (refer to drawing 7 (b)) in the front-face side of the SOI wafer 100, the structure shown in drawing 7 (a) is acquired by forming the resist layer 44 by which patterning was carried out by acquiring the structure shown in drawing 6 (d), and carrying out dry etching of the silicon nitride 19a by the side of the front face of the SOI wafer 100 by using the resist layer 44 as a mask. In addition, as etching gas, CF4 gas etc. is used, for example.

[0060] Next, the above-mentioned contact hole 45 is formed by carrying out wet etching of the silicon oxide 18a by the side of the front face of the SOI wafer 100 in a fluoric acid system water solution (for example, BHF) by using the resist layer 44 as a mask, and the structure shown in drawing 7 R> 7 (b) is acquired.

[0061] Then, after removing the resist layer 44, the structure shown in drawing 7 (c) is acquired by making the metal thin film 46 which consists of Ai-Si (the content of Si is about 1%) all over the front-face side of the SOI wafer 100 deposit with a spatter thru/or vacuum deposition so that a contact hole 45 may be embedded. In addition, the thickness of the metal thin film 46 is set as about several micrometers.

[0062] Then, in order to form a pad 16, the metal wiring 21, and the metal layer 22 for junction in the front-face side of the SOI wafer 100, the structure shown in drawing 8 (a) is acquired by forming the resist layer 47 by which patterning was carried out. In addition, the photoresist of a negative mold is used for the resist layer 47.
[0063] Then, by carrying out wet etching of the metal thin film 46 with the mixed liquor of a phosphoric acid and a nitric acid by using the resist layer 47 as a mask, the pad 16, the metal wiring 21, and the electrode 17 for junction which consist of some metal thin films 46, respectively are formed, and the structure shown in drawing 8 (b) is acquired.
[0064] Next, by forming the resist layer 48 by which patterning was carried out in order to form the above-mentioned slit 14 in the front-face side of the SOI wafer 100, after removing the above-mentioned resist layer 47 The structure shown in drawing 8 (c) is acquired, and the structure shown in drawing 8 (d) is acquired by carrying out dry etching of silicon nitride 19a and silicon oxide 18a by the side of the front face of the SOI wafer 100 by using the resist layer 48 as a mask. In addition, as etching gas, that what is necessary is just to use CF4 gas as etching gas of silicon nitride 19a, although what is necessary is just to use CF4 gas, CHF3 gas, Ar gas, and O2 gas as etching gas of silicon oxide 18a, especially etching gas is not limited, for example.
[0065] Then, the structure shown in drawing 9 (a) is acquired by carrying out dry etching of all of silicon nitride 19b by the side of the rear face of the SOI wafer 100, and the great portion of silicon oxide 18b by the side of a rear face. In here, the thickness of silicon oxide 18b before etching is set as about 1 micrometer, and the thickness of silicon oxide 18b after etching is set as about 1000A. The thickness of silicon oxide 18b after this etching should just be the thickness of extent removable at the process which removes a part of embedded insulating layer 102 later. In addition, the thickness of the embedded insulating layer 102 is set as about 0.3-1 micrometer.
[0066] Next, the structure shown in drawing 9 (b) is acquired by forming the resist layer 49 all over the front-face side of the SOI wafer 100. In here, the resist layer 49 applies a photoresist all over the front-face side of the SOI wafer 100, expose it completely by ultraviolet rays, and it is made to harden it using a mask aligner etc., and is formed by performing postbake after that. In addition, as for the thickness of the resist layer 49, it is desirable to set it as several micrometers or more in consideration of the etching resistance by the below-mentioned TMAH, and by setting it as several micrometers or more, it can raise the mechanical strength of the SOI wafer 100 while it can prevent a permeate lump of TMAH.
[0067] Then, the structure shown in drawing 9 R> 9 (d) is acquired by carrying out anisotropic etching by acquiring the structure shown in drawing 9 (c), then removing the resist layer 49 by the side of the front face of the SOI wafer 100 with a fuming nitric acid until it reaches the embedded insulating layer 102 from the rear face of the SOI wafer 100 with an alkali system solution like TMAH by using silicon oxide 18b by the side of the resist layer 49 and the rear face of the SOI wafer 100 as a mask.
[0068] Next, the structure shown in drawing 10 (a) is acquired by carrying out anisotropic etching until it reaches the embedded insulating layer 102 with an alkali system solution like TMAH in the part corresponding to the above-mentioned slit 14 from the front-face side of the SOI wafer 100. In addition, since TMAH is used as an alkali system solution in this anisotropic etching, the front-face side of the SOI wafer 100 reaches pad 16, and the metal wiring 21 and the metal layer 22 for junction are not eaten away. Moreover, as for etching from the front-face side of this SOI wafer 100, it is desirable to shorten time amount of the over etching after the so-called just etching as much as possible.
[0069] Then, a slit 14 is formed by etching the part exposed in the embedded insulating layer 102 of the SOI wafer 100 in the water solution of a fluoric acid system, and the structure shown in drawing 10 (b) is acquired. In addition, in the water solution used here, in order to suppress pervasion of the pad 16 by the side of the front face of the SOI wafer 100, the metal wiring 21, and the metal layer 22 for junction, it is desirable to mix ethylene glycol etc.
[0070] Next, the structure shown in drawing 10 (c) is acquired by joining the 1st glass substrate 300 with which much coverings 3 were beforehand formed in the front-face side of the SOI wafer 100 by anode plate junction. In addition, although Pyrex (trademark) is used as the 1st glass substrate 300, what is necessary is just the ingredient in which anode plate junction on the body 1 of a sensor is possible (however, it is desirable to choose an ingredient with a small coefficient of thermal expansion with silicon). Moreover, what is necessary is just to vapor-deposit gold beforehand to the SOI wafer 100, in joining using the eutectic of gold and silicon.
[0071] Then, by joining the 2nd glass substrate 200 with which much coverings 2 were beforehand formed in the rear-face side of the SOI wafer 100 by anode plate junction, the structure shown in drawing 10 R> 0 (d) is acquired, and the semi-conductor acceleration sensor which consists of a body 1 of a sensor and coverings 2 and 3 of a couple is obtained by performing dicing after that. In addition, it is desirable to choose the thing of the same ingredient as the 1st glass substrate 300 as the 2nd glass substrate 200.
[0072] according to the above-mentioned manufacture approach -- the SOI wafer 100 -- setting -- bending -- the section 13 and a slit 14 -- it being alike, respectively and the predetermined thickness after the anisotropic etching by corresponding KOH of a part Since it is set as extent which can prevent breakage of the SOI wafer 100 until a pad 16 is formed Can prevent that the SOI wafer 100 is destroyed in the middle of a production process, yield becomes high, can attain low cost-ization, and by breakage of the bending section 13 being prevented further Since it becomes possible to bend without worsening yield and to make thickness of the section 13 thin, high sensitivity-ization of a semi-conductor acceleration sensor can be attained. And since anisotropic etching of the part corresponding to a slit 14 is carried out from the front face of the SOI wafer 100 using TMAH until it reaches the embedded insulating layer 102 after carrying out anisotropic etching until it reaches the embedded insulating layer 102 from a rear-face side beforehand in the part corresponding to a slit 14 in the SOI wafer 100, over etching time amount from a just-etching event can be shortened and a chamfer 26 is formed, a shock-proof high semi-conductor acceleration sensor can be offered.
[0073] By the way, in order to form the above-mentioned slit 14, anisotropic etching by TMAH is performed from the front face of the SOI wafer 100, but at this etching process, silicon nitride 19a (refer to drawing 10 (a)) is used for the front-face side of the SOI wafer 100 as a wrap mask so that opening of the part corresponding to a slit 14 may be carried out and the part corresponding to the bending section 13, a housing 11, the weight section 12, and a chamfer 26 may be protected. In

addition, with this operation gestalt, although KOH eats A-Si and SiO2 away, since TMAH which does not eat away aluminum-Si which is the ingredient of a pad 16, the metal wiring 21, and the metal layer 22 for junction about the anisotropic etching of the barrier layer 103 from the front-face side of the SOI wafer 100 is performing, it is not necessary to protect a pad 16, the metal wiring 21, and the metal layer 22 for junction. Moreover, compared with the field (111), as for the etching rate of the silicon layer (a barrier layer 103, supporters 101) by TMAH, the direction of a field (110) is 100 or more times.

[0074] In order to form the chamfer 26 as shown in drawing 11 (b), patterning of the silicon nitride 19a (mask nitride 19a is called hereafter) used as the mask at the time of TMAH performing anisotropic etching of a barrier layer 103 is carried out to the flat-surface configuration as shown in drawing 11 (a). That is, the chamfer 26 of a configuration as shown in drawing 11 (b) by performing anisotropic etching by using as a mask mask nitride 19a by which patterning was carried out as shown in drawing 11 (a) is formed. Here, as shown in drawing 11 (a), in mask nitride 19a, the periphery of the part 27 corresponding to the chamfer 26 of drawing 11 (b) is formed along with the hypotenuse of the virtual right-angle 2 equilateral triangle 60 which bends with the straight line which connects the ends of the part 27 corresponding to a chamfer 26, and uses the interior angle of 45 degrees with the straight line 28 corresponding to the side edge of the section 13 to make as one basic angle. In addition, 61 in drawing 11 (a) shows the top-most vertices of the above-mentioned virtual right-angle 2 equilateral triangle 60.

[0075] When mask nitride 19a of drawing 11 (a) is used as a mask, the width method (dimension of the vertical direction of drawing 11 (b)) of the bending section 13 becomes a little smaller than the width method (dimension between straight lines 28) of a part which corresponds in mask nitride 19a. The chamfer dimension of a chamfer 26 becomes a little smaller than the dimension (the die length of the hypotenuse of the above-mentioned virtual right-angle 2 equilateral triangle 60) of the part 27 which corresponds in mask nitride 19a.

[0076] By the way, patterning of the mask nitride 19a may be carried out to the flat-surface configuration as shown in each (a) of drawing 12 - drawing 19 . Hereafter, drawing 12 - drawing 19 are explained briefly.

[0077] If anisotropic etching is performed by using as a mask mask nitride 19a by which patterning was carried out as shown in drawing 12 (a), the chamfer 26 of a configuration as shown in drawing 12 (b) will be formed. As shown in drawing 12 (a), in mask nitride 19a, the periphery of the part 27 corresponding to the chamfer 26 of drawing 12 (b) here It is formed in the configuration which dented the hypotenuse of the virtual right-angle 2 equilateral triangle 60 (refer to drawing 11 (a)) which bends with the straight line which connects the ends of the part 27 corresponding to a chamfer 26, and uses the interior angle of 45 degrees with the straight line 28 corresponding to the side edge of the section 13 to make as one basic angle to the top-most-vertices 61 (refer to drawing 11 (a)) side. In addition, in mask nitride 19a, the part 27 corresponding to a chamfer 26 is following smoothly the straight line 28 corresponding to the side edge of the bending section 13, and the straight line (or straight line corresponding to the periphery edge of the weight section 12) corresponding to the inner circumference edge of a housing 11.

[0078] When mask nitride 19a of drawing 12 (a) is used as a mask, the width method (dimension of the vertical direction of drawing 12 (b)) of the bending section 13 becomes a little smaller than the width method (dimension between straight lines 28) of a part which corresponds in mask nitride 19a. The chamfer 26 is retreating rather than the part 27 corresponding to a chamfer 26 (it becomes smaller than the die length of the hypotenuse of the above-mentioned virtual right-angle 2 equilateral triangle 60).

[0079] If anisotropic etching is performed by using as a mask mask nitride 19a by which patterning was carried out as shown in drawing 13 (a), the chamfer 26 of a configuration as shown in drawing 13 (b) will be formed. As shown in drawing 13 (a), in mask nitride 19a, the periphery of the part 27 corresponding to the chamfer 26 of drawing 13 (b) here It is formed in the configuration which dented the hypotenuse of the virtual right-angle 2 equilateral triangle 60 (refer to drawing 11 (a)) which bends with the straight line which connects the ends of the part 27 corresponding to a chamfer 26, and uses the interior angle of 45 degrees with the straight line 28 corresponding to the side edge of the section 13 to make as one basic angle to the top-most-vertices 61 (refer to drawing 11 (a)) side. In addition, in mask nitride 19a, as for the periphery of the part 27 corresponding to a chamfer 26, between ends is connected in the shape of the polygonal line.

[0080] When mask nitride 19a of drawing 13 (a) is used as a mask, the width method (dimension of the vertical direction of drawing 13 (b)) of the bending section 13 becomes a little smaller than the width method (dimension between straight lines 28) of a part which corresponds in mask nitride 19a, and the chamfer 26 is retreating rather than the part 27 corresponding to a chamfer 26.

[0081] If anisotropic etching is performed by using as a mask mask nitride 19a by which patterning was carried out as shown in drawing 14 (a), the chamfer 26 of a configuration as shown in drawing 14 (b) will be formed. Here, as shown in drawing 14 (a), in mask nitride 19a, the hypotenuse of the virtual right-angle 2 equilateral triangle 60 which the periphery of the part 27 corresponding to the chamfer 26 of drawing 14 (b) bends with the straight line which connects the ends of the part 27 corresponding to a chamfer 26, and uses the interior angle of 45 degrees with the straight line 28 corresponding to the side edge of the section 13 to make as one basic angle is formed in the configuration where top-most vertices 61 swelled to the opposite hand. In addition, in mask nitride 19a, the periphery of the part 27 corresponding to a chamfer 26 has become L character-like.

[0082] When mask nitride 19a of drawing 14 (a) is used as a mask, the width method (dimension of the vertical direction of drawing 14 (b)) of the bending section 13 becomes a little smaller than the width method (dimension between straight lines 28) of a part which corresponds in mask nitride 19a, and a chamfer 26 retreats rather than the part 27 corresponding to a chamfer 26, and is formed in the configuration which swelled to the method of outside.

[0083] If anisotropic etching is performed by using as a mask mask nitride 19a by which patterning was carried out as shown in drawing 15 (a), the chamfer 26 of a configuration as shown in drawing 15 (b) will be formed. Here, as shown in drawing 15 (a), in mask nitride 19a, the hypotenuse of the virtual right-angle 2 equilateral triangle 60 which the periphery of the part 27 corresponding to the chamfer 26 of drawing 15 (b) bends with the straight line which connects the ends of the part 27

.corresponding to a chamfer 26, and uses the interior angle of 45 degrees with the straight line 28 corresponding to the side edge of the section 13 to make as one basic angle is formed in the configuration where top-most vertices 61 swelled to the opposite hand. In addition, in mask nitride 19a, the periphery of the part 27 corresponding to a chamfer 26 is formed in the shape of [which continues smoothly] radii.
[0084] When mask nitride 19a of drawing 15 (a) is used as a mask, the width method (dimension of the vertical direction of drawing 15 (b)) of the bending section 13 becomes a little smaller than the width method (dimension between straight lines 28) of a part which corresponds in mask nitride 19a, and a chamfer 26 retreats rather than the part 27 corresponding to a chamfer 26, and is formed in the configuration which swelled to the method of outside.
[0085] If anisotropic etching is performed by using as a mask mask nitride 19a by which patterning was carried out as shown in drawing 16 (a), the chamfer 26 of a configuration as shown in drawing 16 (b) will be formed. As shown in drawing 16 (a), in mask nitride 19a, the periphery of the part 27 corresponding to the chamfer 26 of drawing 16 (b) here The ends of the part 27 corresponding to a chamfer 26 The hypotenuse of the virtual right-angle 2 equilateral triangle 60 (refer to drawing 15 (a)) which bends with the straight line to connect and uses the interior angle of 45 degrees with the straight line 28 corresponding to the side edge of the section 13 to make as one basic angle is formed in the configuration where top-most vertices 61 (refer to drawing 15 (a)) swelled to the opposite hand. In addition, in mask nitride 19a, the periphery of the part 27 corresponding to a chamfer 26 is stair-like.
[0086] When mask nitride 19a of drawing 16 (a) is used as a mask, the width method (dimension of the vertical direction of drawing 16 (b)) of the bending section 13 becomes a little smaller than the width method (dimension between straight lines 28) of a part which corresponds in mask nitride 19a, a chamfer 26 retreats rather than the part 27 corresponding to a chamfer 26, and two or more heights are formed.
[0087] If anisotropic etching is performed by using as a mask mask nitride 19a by which patterning was carried out as shown in drawing 17 (a), the chamfer 26 of a configuration as shown in drawing 17 (b) will be formed. As shown in drawing 17 (a), in mask nitride 19a, the periphery of the part 27 corresponding to the chamfer 26 of drawing 17 (b) here The ends of the part 27 corresponding to a chamfer 26 The hypotenuse of the virtual right-angle 2 equilateral triangle 60 (refer to drawing 15 (a)) which bends with the straight line to connect and uses the interior angle of 45 degrees with the straight line 28 corresponding to the side edge of the section 13 to make as one basic angle is formed in the configuration where top-most vertices 61 (refer to drawing 15 (a)) swelled to the opposite hand.
[0088] When mask nitride 19a of drawing 17 (a) is used as a mask, the width method (dimension of the vertical direction of drawing 17 (b)) of the bending section 13 becomes a little smaller than the width method (dimension between straight lines 28) of a part which corresponds in mask nitride 19a, and a chamfer 26 retreats rather than the part 27 corresponding to a chamfer 26, and is formed in the configuration which swelled to the method of outside.
[0089] If anisotropic etching is performed by using as a mask mask nitride 19a by which patterning was carried out as shown in drawing 18 (a), the chamfer 26 of a configuration as shown in drawing 18 (b) will be formed. Here, as shown in drawing 18 (a), in mask nitride 19a, the periphery of the part 27 corresponding to the chamfer 26 of drawing 18 (b) is formed along with the hypotenuse of the virtual right triangle 70 which bends with the straight line which connects the ends of the part 27 corresponding to a chamfer 26, and uses the interior angle of 45 degrees with the straight line 28 corresponding to the side edge of the section 13 to make as one basic angle.
[0090] When mask nitride 19a of drawing 18 (a) is used as a mask, the width method (dimension of the vertical direction of drawing 18 (b)) of the bending section 13 becomes a little smaller than the width method (dimension between straight lines 28) of a part which corresponds in mask nitride 19a, and the chamfer 26 is retreating rather than the part 27 corresponding to a chamfer 26 (it becomes smaller than the die length of the hypotenuse of the above-mentioned virtual right triangle 70). If the chamfer 26 of the configuration shown in drawing 18 (b) is formed, the mechanical strength in the ends of the bending section 13 can be raised.
[0091] If anisotropic etching is performed by using as a mask mask nitride 19a by which patterning was carried out as shown in drawing 19 (a), the chamfer 26 of a configuration as shown in drawing 19 (b) will be formed. Here, as shown in drawing 19 (a), in mask nitride 19a, the periphery of the part 27 corresponding to a chamfer 26 is formed in accordance with the periphery of a virtual circle which makes the linear dimension of the bending section 13 a diameter, and touches the part corresponding to the side edge of the bending section 13.
[0092] When mask nitride 19a of drawing 19 (a) is used as a mask, The width method (dimension of the vertical direction of drawing 19 (b)) of the bending section 13 bends in mask nitride 19a, and among the tangents of the above-mentioned virtual circle by the side of the 1 side edge of the part corresponding to the section 13 (on drawing 19 (a)) A tangent parallel to the extended direction of the bending section 13, As soon as it spreads abbreviation etc. on the dimension between tangents parallel to the extended direction of the bending section 13 among the contacts of the above-mentioned virtual circle by the side of the other side edges of the part corresponding to the bending section 13 (under drawing 19 (a)), a chamfer 26 becomes the same configuration as drawing 11 (b).
[0093] By the way, although the two bending sections 13 are estranged and formed in the direction (the vertical direction of drawing 1 (b)) in alignment with one side of the weight section 12 and have formed each chamfer 26 in the same size by the body 1 of a sensor in an above-mentioned semi-conductor acceleration sensor, a configuration as shown in drawing 20 may be adopted. Each bending section 13 in drawing 20 has made size of the chamfer 26 by the side of a reverse side face larger than the chamfer 26 by the side of the side face which counters mutually in the direction (the vertical direction of drawing 20) met the up Norikazu side. That is, it is H2, then H2>H1 about the dimension in the direction met the up Norikazu side of the chamfer 26 by the side of H1 and a reverse side face in the dimension in the direction met the up Norikazu side of the chamfer 26 by the side of the side face which counters mutually in the direction met the up Norikazu side. Although stress concentrates on the chamfer 26 of the side face of the above-mentioned opposite hand when the weight section 12 can twist centering on the center line B parallel to the extended direction of each bending section 13 or the point of the weight section 12 sways in the direction (sense of the arrow head C in drawing 20) met the up Norikazu side, stress is eased

because it is H2>H1, and it can prevent that the bending section 13 breaks.
[0094] (Operation gestalt 2) Since the basic configuration of the semi-conductor acceleration sensor of this operation gestalt is the same as the operation gestalt 1 and the manufacture approach is different, below, it explains, referring to drawing 21 about the point which is different from the manufacture approach of the operation gestalt 1 in the manufacture approach. In addition, the same sign is given to the same component as the operation gestalt 1, and explanation is omitted.
[0095] In the manufacture approach explained with the operation gestalt 1, the resist layer 49 is formed all over the front-face side of the SOI wafer 100 like above-mentioned drawing 9 (b). Silicon oxide 18b by the side of the resist layer 49 and the rear face of the SOI wafer 100 is used as a mask. By carrying out anisotropic etching, the structure shown in drawing 21 (a) is acquired until it reaches the embedded insulating layer 102 from the rear face of the SOI wafer 100 with an alkali system solution like TMAH (drawing 21 (a) is the same structure as drawing 9 (c)).
[0096] Then, the structure shown in drawing 21 (b) is acquired by etching to the middle the part exposed among the embedded insulating layers 102 in a fluoric acid system water solution. In addition, silicon oxide 18b by the side of the rear face of the SOI wafer 100 as well as the embedded insulating layer 102 becomes thin in the case of this etching.
[0097] Next, the structure shown in drawing 2121 (c) is acquired by removing the resist layer 49 by the side of the front face of the SOI wafer 100 with a fuming nitric acid.
[0098] Then, the structure shown in drawing 21 (d) is acquired by carrying out anisotropic etching until it reaches the embedded insulating layer 102 with an alkali system solution like TMAH in the part corresponding to the above-mentioned slit 14 from the front-face side of the SOI wafer 100 by using silicon nitride 19a as a mask. In addition, as for etching from the front-face side of this SOI wafer 100, it is desirable to shorten time amount of the over etching after the so-called just etching as much as possible.
[0099] Then, a slit 14 is formed by etching the part exposed in the embedded insulating layer 102 of the SOI wafer 100 in the water solution of a fluoric acid system, and the structure shown in drawing 21 (e) is acquired. In addition, with this operation gestalt, since the thickness of the exposed part of the embedded insulating layer 102 is thin compared with other parts in etching the embedded insulating layer 102 in the water solution of a fluoric acid system, pervasion of the pad 16 by the side of the front face of the SOI wafer 100, the metal wiring 21, and the metal layer 22 for junction can be prevented.
[0100] Future production processes are the same as the operation gestalt 1.
[0101] Also by the manufacture approach of this operation gestalt, the same effectiveness as the manufacture approach of the operation gestalt 1 is acquired, and a shock-proof high semi-conductor acceleration sensor can be obtained.
[0102] (Operation gestalt 3) Since the basic configuration of the semi-conductor acceleration sensor of this operation gestalt is the same as the operation gestalt 1 and the manufacture approach is different, below, it explains, referring to drawing 22 about the point which is different from the manufacture approach of the operation gestalt 1 in the manufacture approach. In addition, the same sign is given to the same component as the operation gestalt 1, and explanation is omitted.
[0103] In the manufacture approach explained with the operation gestalt 1, silicon oxide 18b by the side of the resist layer 49 by the side of the front face of the SOI wafer 100 and the rear face of the SOI wafer 100 is used as a mask like drawing 9 (c). Anisotropic etching is carried out until it reaches the embedded insulating layer 102 from the rear face of the SOI wafer 100 with an alkali system solution like TMAH. Then, after removing the resist layer 49 by the side of the front face of the SOI wafer 100 like drawing 9 (d), silicon nitride 19a is used as a mask. By carrying out anisotropic etching until it reaches the embedded insulating layer 102 with an alkali system solution like TMAH in the part corresponding to the above-mentioned slit 14 from the front-face side of the SOI wafer 100 The structure shown in drawing 22 (a) is acquired (drawing 22 (a) is the same structure as drawing 10 (a)).
[0104] Then, the structure shown in drawing 22 (b) is acquired by performing isotropic etching of a barrier layer 103 and supporters 101 from the front flesh-side both sides of the SOI wafer 100. In addition, what is necessary is just to set up the etching time of this isotropic etching so that a boundary part with the part which becomes the part exposed in the embedded insulating layer 102, the part which becomes a housing 11, and the weight section 12 may become the configuration which continues smoothly. What is necessary is in other words, just to set up etching time so that it may become the configuration which eases the stress concentrated on a boundary part when the part which becomes the weight section 12 sways in the thickness direction.
[0105] Next, a slit 14 is formed by etching the part exposed in the embedded insulating layer 102 of the SOI wafer 100 in the water solution of a fluoric acid system, and the structure shown in drawing 22 (c) is acquired. Future production processes are the same as the operation gestalt 1.
[0106] Also by the manufacture approach of this operation gestalt, the same effectiveness as the manufacture approach of the operation gestalt 1 is acquired, and a shock-proof high semi-conductor acceleration sensor can be obtained.
[0107] (Operation gestalt 4) Since the basic configuration of the semi-conductor acceleration sensor of this operation gestalt is the same as the operation gestalt 1 and the manufacture approach is different, below, it explains, referring to drawing 23 about the point which is different from the manufacture approach of the operation gestalt 1 in the manufacture approach. In addition, the same sign is given to the same component as the operation gestalt 1, and explanation is omitted.
[0108] In the manufacture approach explained with the operation gestalt 1, silicon oxide 18b by the side of the resist layer 49 by the side of the front face of the SOI wafer 100 and the rear face of the SOI wafer 100 is used as a mask like drawing 9 (c). Anisotropic etching is carried out until it reaches the embedded insulating layer 102 from the rear face of the SOI wafer 100 with an alkali system solution like TMAH. Then, after removing the resist layer 49 by the side of the front face of the SOI wafer 100 like drawing 9 (d), silicon nitride 19a is used as a mask. By carrying out anisotropic etching until it reaches the embedded insulating layer 102 with an alkali system solution like TMAH in the part corresponding to the above-mentioned slit 14 from the front-face side of the SOI wafer 100 The structure shown in drawing 23 (a) is acquired (drawing 23 (a) is the same structure as drawing 10 (a)).
[0109] Then, the structure shown in drawing 23 (b) is acquired by removing silicon oxide 18b by the side of the embedded insulating layer 102 of the part corresponding to a slit 14 and the bending section 13, and the rear face of the SOI wafer 100

from the rear-face side of the SOI wafer 100 by dry etching in the SOI wafer 100. In addition, it is desirable to use the dry cleaning dirty-as etching system used by dry etching char which can etch a high aspect ratio, for example, it should just use the dry etcher of an ICP (inductively coupled plasma) mold.
[0110] Future production processes are the same as the operation gestalt 1.
[0111] Also by the manufacture approach of this operation gestalt, the same effectiveness as the manufacture approach of the operation gestalt 1 is acquired, and a shock-proof high semi-conductor acceleration sensor can be obtained. Moreover, since dry etching has removed the embedded insulating layer 102 of the part corresponding to a slit 14 and the bending section 13 from the rear-face side of the SOI wafer 100 in the SOI wafer 100, the embedded insulating layer 102 can be removed, without not putting the front-face side of the SOI wafer 100 to the plasma, and giving an etching damage to the front-face side of the SOI wafer 100.
[0112] (Operation gestalt 5) Since the basic configuration of the semi-conductor acceleration sensor of this operation gestalt is the same as the operation gestalt 1 and the manufacture approach is different, below, it explains, referring to drawing 24 and drawing 2525 about the point which is different from the manufacture approach of the operation gestalt 1 in the manufacture approach. In addition, the same sign is given to the same component as the operation gestalt 1, and explanation is omitted.
[0113] In the manufacture approach explained with the operation gestalt 1, after carrying out dry etching of all of silicon nitride 19b by the side of the rear face of the SOI wafer 100, and the great portion of silicon oxide 18b by the side of a rear face like above-mentioned drawing 9 (a), the structure shown in drawing 24 (a) is acquired by forming the resist layer 49 all over the front-face side of the SOI wafer 100. In here, the resist layer 49 applies a photoresist to the front-face side of the SOI wafer 100, exposes and carries out ultraviolet curing of the partial 49a other than partial 49b corresponding to the formation part of the slit 14 in the SOI wafer 100, and is formed by performing the postbase after that. Moreover, as for the thickness of the resist layer 49, it is desirable to set it as several micrometers or more.
[0114] The structure shown in drawing 24 (b) is acquired by carrying out anisotropic etching after forming the resist layer 49 until it reaches the embedded insulating layer 102 from the rear face of the SOI wafer 100 with an alkali system solution like TMAH by using silicon oxide 18b by the side of the resist layer 49 and the rear face of the SOI wafer 100 as a mask.
[0115] Then, the structure shown in drawing 24 (c) is acquired by carrying out exfoliation clearance of the partial 49b corresponding to the formation part of a slit 14 with a developer among the resist layers 49 by the side of SOI wafer 100 front face, then etching silicon nitride 19a and silicon oxide 18a by the side of the front face of the SOI wafer 100 by using the resist layer 49 as a mask.
[0116] Next, the structure shown in drawing 24 (d) is acquired by carrying out anisotropic etching until it reaches the embedded insulating layer 102 with an alkali system solution like TMAH in the part corresponding to the above-mentioned slit 14 from the front-face side of the SOI wafer 100 by using the resist layer 49 as a mask. In addition, as for etching from the front-face side of this SOI wafer 100, it is desirable to shorten time amount of the over etching after the so-called just etching as much as possible.
[0117] Then, a slit 14 is formed by etching the part exposed in the embedded insulating layer 102 of the SOI wafer 100 in the water solution of a fluoric acid system, and the structure shown in drawing 25 (a) is acquired. Then, the structure shown in drawing 25 (b) is acquired by removing the resist layer 49. Future production processes are the same as the operation gestalt 1.
[0118] Also by the manufacture approach of this operation gestalt, the same effectiveness as the manufacture approach of the operation gestalt 1 is acquired, and a shock-proof high semi-conductor acceleration sensor can be obtained. Moreover, since the pad 16 by the side of the front face of the SOI wafer 100, the metal wiring 21, and the metal layer 22 for junction are covered with the resist layer 49 and protected in case the embedded insulating layer 102 is etched in the water solution of a fluoric acid system, it can prevent certainly being eaten away in the water solution of a fluoric acid system.
[0119] (Operation gestalt 6) Since the basic configuration of the semi-conductor acceleration sensor of this operation gestalt is the same as the operation gestalt 1 and the manufacture approach is different, below, it explains, referring to drawing 26 and drawing 2727 about the point which is different from the manufacture approach of the operation gestalt 1 in the manufacture approach. In addition, the same sign is given to the same component as the operation gestalt 1, and explanation is omitted.
[0120] The resist layer 48 by which patterning was carried out in the manufacture approach explained with the operation gestalt 1 in order to form the above-mentioned slit 14 in the front-face side of the SOI wafer 100 like drawing 8 (c) is formed. After carrying out dry etching of silicon nitride 19a and silicon oxide 18a by the side of the front face of the SOI wafer 100 by using the resist layer 48 as a mask like drawing 8 (d), By carrying out dry etching of all of silicon nitride 19b by the side of the rear face of the SOI wafer 100, and the great portion of silicon oxide 18b by the side of a rear face, the structure shown in drawing 26 R> 6 (a) is acquired (drawing 26 (a) is the same structure as drawing 9 (a)).
[0121] Then, after a fuming nitric acid removes the resist layer 48 by the side of the front face of the SOI wafer 100, the structure shown in drawing 26 (b) is acquired by forming the resist layer 51 all over the rear-face side of the SOI wafer 100. In here, after the resist layer 51 applies and exposes a photoresist completely to the rear-face side of the SOI wafer 100, it is formed by performing the postbase. Moreover, as for the thickness of the resist layer 51, it is desirable to set it as several micrometers or more.
[0122] Next, the structure shown in drawing 26 (c) is acquired by carrying out anisotropic etching until it reaches the embedded insulating layer 102 with an alkali system solution like TMAH in the part corresponding to the above-mentioned slit 14 from the front-face side of the SOI wafer 100 by using the resist layer 51 by the side of silicon nitride 19a by the side of the front face of the SOI wafer 100, and a rear face as a mask. In addition, as for etching from the front-face side of this SOI wafer 100, it is desirable to shorten time amount of the over etching after the so-called just etching as much as possible.
[0123] Then, by removing the resist layer 51 by the side of the rear face of the SOI wafer 100 with a fuming nitric acid The

structure shown in drawing 27 R> 7 (a) is acquired, then the resist layer 52 is formed all over the front-face side of the SOI wafer 100 (the resist layer 52). Silicon oxide 18b by the side of the resist layer 52 by the side of the front face of the SOI wafer 100 and a rear face currently formed by performing the postbase after applying and exposing a photoresist completely to the front-face side of the SOI wafer 100 is used as a mask. By carrying out anisotropic etching, the structure shown in drawing 27 (b) is acquired until it reaches the embedded insulating layer 102 with an alkali system solution like TMAH from the rear-face side of the SOI wafer 100.

[0124] Then, after a fuming nitric acid removes the resist layer 52 by the side of the front face of the SOI wafer 100, a slit 14 is formed by etching the part exposed in the embedded insulating layer 102 of the SOI wafer 100 in the water solution of a fluoric acid system, and the structure shown in drawing 27 (c) is acquired. Future production processes are the same as the operation gestalt 1.

[0125] Also by the manufacture approach of this operation gestalt, the same effectiveness as the manufacture approach of the operation gestalt 1 is acquired, and a shock-proof high semi-conductor acceleration sensor can be obtained. Moreover, since the rear-face side of the SOI wafer 100 is covered with the resist layer 51 with this operation gestalt in case anisotropic etching of the part corresponding to a slit 14 is carried out by TMAH from the front-face side of the SOI wafer 100 in the SOI wafer 100, it is advantageous, when the supporters 102 by the side of the rear face of the SOI wafer 100 are not etched in the case of this anisotropic etching and the miniaturization of the body 1 of a sensor is attained. For example, when the weight of the weight section 12 is comparatively small, it can prevent that supporters 102 are etched in the case of the anisotropic etching from the front-face side of this SOI wafer 100, and the weight of the weight section 12 falls.

[0126]

[Effect of the Invention] Invention of claim 1 is connected with a housing at one through the bending section in which the weight section arranged in the opening aperture penetrated on the front reverse side of a rectangle frame-like housing has flexibility. And the body of a sensor with which the gage resistance which detects the stress which bends according to an operation of the acceleration to the weight section, and is produced in the section bent, it was prepared in the section, and the electrode for I/O was prepared in the front-face side of a housing, The 1st covering joined to the housing so that said opening aperture might be covered to the front-face side of the body of a sensor, It has the 2nd covering joined to the housing so that said opening aperture might be covered to the rear-face side of the body of a sensor. The bending section It is the thing which is prepared in the front-face side of the body of a sensor, and bends so that the both ends of the extended direction may become broader than a center section and which comes to form a chamfer between the both-sides side of the section, the inner skin of a housing, and the peripheral face of the weight section. Since it bends so that the both ends of the extended direction of the bending section may become broader than a center section, and the chamfer is formed between the both-sides side of the section, the inner skin of a housing, and the peripheral face of the weight section, it is effective in the shock resistance of the bending section improving and the shock resistance as a semi-conductor acceleration sensor improving.

[0127] In invention of claim 1, since said gage resistance is formed in the part except said both ends in said bending section, invention of claim 2 is effective in the ability to lessen effect of said chamfer to output characteristics.

[0128] Invention of claim 3 is equipped with said two bending sections in invention of claim 1 or claim 2. Since said each bending section is estranged and formed in the direction in alignment with one side of said weight section and said each bending section has made size of the chamfer by the side of a reverse side face larger than the chamfer by the side of the side face which counters mutually in the direction in alignment with said one side It is effective in the ability to sway in the direction which the point of said weight section meets the up Norikazu side, or prevent that stress concentrates in a distorted case, bend to a center line with said weight section parallel to the extended direction of said bending section, and the section breaks.

[0129] Invention of claim 6 is the manufacture approach of a semi-conductor acceleration sensor according to claim 5. The thickness of the part corresponding to the slit formed except for said bending section in a SOI wafer between said weight sections and said housings and said each of bending section is larger than the thickness adding said the 2nd silicon layer and said embedded insulation layer thickness. The 1st etching process which carries out anisotropic etching from the rear face of a SOI wafer using the 1st alkali system solution so that it may become the predetermined thickness set as extent which can prevent breakage of a SOI wafer until said electrode is formed, The 2nd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit and said each of bending section from the rear-face side of a SOI wafer using the 2nd alkali system solution until it reaches said embedded insulating layer after forming said electrode, The 3rd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer, It has the 4th etching process which removes said embedded insulating layer of the part corresponding to said slit and said bending section in a SOI wafer. At said 3rd etching process It is characterized by using a wrap mask for the front-face side of a SOI wafer so that opening of the part corresponding to said slit may be carried out and the part corresponding to said bending section, said housing, said weight section, and said chamfer may be protected.

[0130] Since according to this manufacture approach it is set as extent which can prevent breakage of a SOI wafer until said electrode is formed in said predetermined thickness Can prevent that a SOI wafer is destroyed in the middle of a production process, yield becomes high, can attain low cost-ization, and by breakage of said bending section being prevented further Since it becomes possible to make thickness of said bending section thin, without worsening yield Are effective in the ability to attain high sensitivity-ization of a semi-conductor acceleration sensor. Moreover Until it reaches said embedded insulating layer from a rear-face side beforehand in the part corresponding to said slit in a SOI wafer Since anisotropic etching of the part corresponding to said slit is carried out from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer after carrying out anisotropic etching Since over etching time amount from a just-etching event can be shortened and said chamfer is formed, it is effective in the ability to offer a shock-proof high semi-conductor acceleration sensor.

[0131] Invention of claim 7 is the manufacture approach of a semi-conductor acceleration sensor according to claim 5. The thickness of the part corresponding to the slit formed except for said bending section in a SOI wafer between said weight sections and said housings and said each of bending section is larger than the thickness adding said the 2nd silicon layer and said embedded insulation layer thickness. The 1st etching process which carries out anisotropic etching from the rear face of a SOI wafer using the 1st alkali system solution so that it may become the predetermined thickness set as extent which can prevent breakage of a SOI wafer until said electrode is formed, The 2nd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit and said each of bending section from the rear-face side of a SOI wafer using the 2nd alkali system solution until it reaches said embedded insulating layer after forming said electrode, The 3rd etching process which etches to the middle said embedded insulating layer exposed after the 2nd etching process, The 4th etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer, It has the 5th etching process which removes said embedded insulating layer of the part corresponding to said slit and said bending section in a SOI wafer. At said 4th etching process It is characterized by using a wrap mask for the front-face side of a SOI wafer so that opening of the part corresponding to said slit may be carried out and the part corresponding to said bending section, said housing, said weight section, and said chamfer may be protected.
[0132] Since according to this manufacture approach it is set as extent which can prevent breakage of a SOI wafer until said electrode is formed in said predetermined thickness Can prevent that a SOI wafer is destroyed in the middle of a production process, yield becomes high, can attain low cost-ization, and by breakage of said bending section being prevented further Since it becomes possible to make thickness of said bending section thin, without worsening yield Are effective in the ability to attain high sensitivity-ization of a semi-conductor acceleration sensor. Moreover In a SOI wafer, beforehand the part corresponding to said slit from a rear-face side to the middle of said embedded insulating layer Since anisotropic etching of the part corresponding to said slit is carried out from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer after etching Since over etching time amount from a just-etching event can be shortened and said chamfer is formed, it is effective in the ability to offer a shock-proof high semi-conductor acceleration sensor.
[0133] Invention of claim 8 is the manufacture approach of a semi-conductor acceleration sensor according to claim 5. The thickness of the part corresponding to the slit formed except for said bending section in a SOI wafer between said weight sections and said housings and said each of bending section is larger than the thickness adding said the 2nd silicon layer and said embedded insulation layer thickness. The 1st etching process which carries out anisotropic etching from the rear face of a SOI wafer using the 1st alkali system solution so that it may become the predetermined thickness set as extent which can prevent breakage of a SOI wafer until said electrode is formed, The 2nd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit and said each of bending section from the rear-face side of a SOI wafer using the 2nd alkali system solution until it reaches said embedded insulating layer after forming said electrode, The 3rd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer, The 4th etching process which performs isotropic etching of each of said silicon layer from the front flesh-side both sides of a SOI wafer using the mask used at said each etching process, It has the 5th etching process which removes said embedded insulating layer of the part corresponding to said slit and said bending section in a SOI wafer. At said 3rd etching process It is characterized by using a wrap mask for the front-face side of a SOI wafer so that opening of the part corresponding to said slit may be carried out and the part corresponding to said bending section, said housing, said weight section, and said chamfer may be protected.
[0134] Since according to this manufacture approach it is set as extent which can prevent breakage of a SOI wafer until said electrode is formed in said predetermined thickness Can prevent that a SOI wafer is destroyed in the middle of a production process, yield becomes high, can attain low cost-ization, and by breakage of said bending section being prevented further Since it becomes possible to make thickness of said bending section thin, without worsening yield It is effective in the ability to attain high sensitivity-ization of a semi-conductor acceleration sensor, and moreover, since it has the 4th etching process which performs isotropic etching of each of said silicon layer from the front flesh-side both sides of a SOI wafer Can ease the stress concentrated on a boundary part with said embedded insulating layer and said housing, and said weight section in the middle of a production process, and are effective in the ability to prevent breakage of a SOI wafer. Moreover, Until it reaches said embedded insulating layer from a rear-face side beforehand in the part corresponding to said slit in a SOI wafer Since anisotropic etching of the part corresponding to said slit is carried out from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer after carrying out anisotropic etching Since over etching time amount from a just-etching event can be shortened and said chamfer is formed, it is effective in the ability to offer a shock-proof high semi-conductor acceleration sensor.
[0135] Invention of claim 9 is the manufacture approach of a semi-conductor acceleration sensor according to claim 5. The thickness of the part corresponding to the slit formed except for said bending section in a SOI wafer between said weight sections and said housings and said each of bending section is larger than the thickness adding said the 2nd silicon layer and said embedded insulation layer thickness. The 1st etching process which carries out anisotropic etching from the rear face of a SOI wafer using the 1st alkali system solution so that it may become the predetermined thickness set as extent which can prevent breakage of a SOI wafer until said electrode is formed, The 2nd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit and said each of bending section from the rear-face side of a SOI wafer using the 2nd alkali system solution until it reaches said embedded insulating layer after forming said electrode, The 3rd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer, It has the 4th etching process which removes said embedded insulating layer of the part corresponding to said slit and said bending section from the rear-face side of a SOI wafer by dry etching in a SOI wafer. At said 3rd etching process, it is characterized

by using a wrap mask for the front-face side of a SOI wafer so that opening of the part corresponding to said slit may be carried out and the part corresponding to said bending section, said housing, said weight section, and said chamfer may be protected.

[0136] Since according to this manufacture approach it is set as extent which can prevent breakage of a SOI wafer until said electrode is formed in said predetermined thickness Can prevent that a SOI wafer is destroyed in the middle of a production process, yield becomes high, can attain low cost-ization, and by breakage of said bending section being prevented further Since it becomes possible to make thickness of said bending section thin, without worsening yield Are effective in the ability to attain high sensitivity-ization of a semi-conductor acceleration sensor. Moreover Until it reaches said embedded insulating layer from a rear-face side beforehand in the part corresponding to said slit in a SOI wafer Since anisotropic etching of the part corresponding to said slit is carried out from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer after carrying out anisotropic etching Since over etching time amount from a just-etching event can be shortened and said chamfer is formed, it is effective in the ability to offer a shock-proof high semi-conductor acceleration sensor. Moreover, since dry etching has removed said embedded insulating layer of the part corresponding to said slit and said bending section from the rear-face side of a SOI wafer in a SOI wafer, it is effective in said embedded insulating layer being removable, without giving an etching damage to the front-face side of a SOI wafer.

[0137] Invention of claim 10 is the manufacture approach of a semi-conductor acceleration sensor according to claim 5. The thickness of the part corresponding to the slit formed except for said bending section in a SOI wafer between said weight sections and said housings and said each of bending section is larger than the thickness adding said the 2nd silicon layer and said embedded insulation layer thickness. The 1st etching process which carries out anisotropic etching from the rear face of a SOI wafer using the 1st alkali system solution so that it may become the predetermined thickness set as extent which can prevent breakage of a SOI wafer until said electrode is formed, The 2nd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit and said each of bending section from the rear-face side of a SOI wafer using the 2nd alkali system solution until it reaches said embedded insulating layer after forming said electrode, The 3rd etching process which carries out anisotropic etching of the part on a SOI wafer and corresponding to said slit from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer, The 4th etching process which removes said embedded insulating layer of the part corresponding to said slit and said bending section in a SOI wafer where the front-face side of a SOI wafer is covered in a resist layer, It has the resist clearance process of removing said resist layer. At said 3rd etching process It is characterized by using a wrap mask for the front-face side of a SOI wafer so that opening of the part corresponding to said slit may be carried out and the part corresponding to said bending section, said housing, said weight section, and said chamfer may be protected.

[0138] Since according to this manufacture approach it is set as extent which can prevent breakage of a SOI wafer until said electrode is formed in said predetermined thickness Can prevent that a SOI wafer is destroyed in the middle of a production process, yield becomes high, can attain low cost-ization, and by breakage of the bending section being prevented further Since it becomes possible to bend without worsening yield and to make thickness of the section thin Are effective in the ability to attain high sensitivity-ization of a semi-conductor acceleration sensor. Moreover Until it reaches said embedded insulating layer from a rear-face side beforehand in the part corresponding to said slit in a SOI wafer Since anisotropic etching of the part corresponding to said slit is carried out from the front face of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer after carrying out anisotropic etching Since over etching time amount from a just-etching event can be shortened and said chamfer is formed, it is effective in the ability to offer a shock-proof high semi-conductor acceleration sensor. Moreover, since said embedded insulating layer of the part corresponding to said slit and said bending section is removed in a SOI wafer where the front-face side of a SOI wafer is covered in a resist layer, in case said embedded insulating layer is removed, it is effective in the ability to protect the front-face side of a SOI wafer.

[0139] Invention of claim 11 is the manufacture approach of a semi-conductor acceleration sensor according to claim 5. The thickness of the part corresponding to the slit formed except for said bending section in a SOI wafer between said weight sections and said housings and said each of bending section is larger than the thickness adding said the 2nd silicon layer and said embedded insulation layer thickness. The 1st etching process which carries out anisotropic etching from the rear face of a SOI wafer using the 1st alkali system solution so that it may become the predetermined thickness set as extent which can prevent breakage of a SOI wafer until said electrode is formed, Where the whole surface by the side of the rear face of a SOI wafer is covered in the 1st resist layer after forming said electrode, it sets to a SOI wafer. The 2nd etching process which carries out anisotropic etching of the part corresponding to said slit from the front face of a SOI wafer using the 2nd alkali system solution until it reaches said embedded insulating layer, The 1st resist clearance process which removes the 1st resist layer, Where the front-face side of a SOI wafer is covered in the 2nd resist layer after the 1st resist clearance process, it sets to a SOI wafer. The 3rd etching process which carries out anisotropic etching of the part corresponding to said slit and said bending section from the rear-face side of a SOI wafer using the 3rd alkali system solution until it reaches said embedded insulating layer, It has the 2nd resist clearance process which removes the 2nd resist layer, and the 4th etching process which removes said embedded insulating layer of the part corresponding to said slit and said bending section in a SOI wafer after the 2nd resist clearance process. It is characterized by using a wrap mask for the front-face side of a SOI wafer so that opening of the part corresponding to said slit may be carried out and the part corresponding to said bending section, said housing, said weight section, and said chamfer may be protected at said 3rd etching process. Said predetermined thickness Since it is set as extent which can prevent breakage of a SOI wafer until said electrode is formed Can prevent that a SOI wafer is destroyed in the middle of a production process, yield becomes high, can attain low cost-ization, and by breakage of the bending section being prevented further Since it becomes possible to bend without worsening yield and to make thickness of the section thin Are effective in the ability to attain high sensitivity-ization of a semi-conductor acceleration sensor. And where the whole surface by the side of the rear face of a SOI wafer is covered in the 1st resist layer, since anisotropic etching of the part corresponding to said slit is carried out from the front face of a SOI wafer using the 2nd alkali system solution until it reaches said embedded insulating layer Since over etching time amount

from a just-etching event can be shortened and said chamfer is formed, it is effective in the ability to offer a shock-proof high semi-conductor acceleration sensor.

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The operation gestalt 1 is shown, (a) is an outline sectional view and (b) is the outline top view of the body of a sensor.
[Drawing 2] It is an important section explanatory view same as the above.
[Drawing 3] It is an important section explanatory view same as the above.
[Drawing 4] It is an important section explanatory view same as the above.
[Drawing 5] It is a main process sectional view for explaining the manufacture approach same as the above.
[Drawing 6] It is a main process sectional view for explaining the manufacture approach same as the above.
[Drawing 7] It is a main process sectional view for explaining the manufacture approach same as the above.
[Drawing 8] It is a main process sectional view for explaining the manufacture approach same as the above.
[Drawing 9] It is a main process sectional view for explaining the manufacture approach same as the above.
[Drawing 10] It is a main process sectional view for explaining the manufacture approach same as the above.
[Drawing 11] It is the explanatory view of the manufacture approach same as the above.
[Drawing 12] It is the explanatory view of the manufacture approach same as the above.
[Drawing 13] It is the explanatory view of the manufacture approach same as the above.
[Drawing 14] It is the explanatory view of the manufacture approach same as the above.
[Drawing 15] It is the explanatory view of the manufacture approach same as the above.
[Drawing 16] It is the explanatory view of the manufacture approach same as the above.
[Drawing 17] It is the explanatory view of the manufacture approach same as the above.
[Drawing 18] It is the explanatory view of the manufacture approach same as the above.
[Drawing 19] It is the explanatory view of the manufacture approach same as the above.
[Drawing 20] It is the outline top view of other examples of a configuration of the body of a sensor same as the above.
[Drawing 21] It is a main process sectional view for explaining the manufacture approach of the operation gestalt 2.
[Drawing 22] It is a main process sectional view for explaining the manufacture approach of the operation gestalt 3.
[Drawing 23] It is a main process sectional view for explaining the manufacture approach of the operation gestalt 4.
[Drawing 24] It is a main process sectional view for explaining the manufacture approach of the operation gestalt 5.
[Drawing 25] It is a main process sectional view for explaining the manufacture approach same as the above.
[Drawing 26] It is a main process sectional view for explaining the manufacture approach of the operation gestalt 6.
[Drawing 27] It is a main process sectional view for explaining the manufacture approach same as the above.
[Drawing 28] The conventional example is shown, (a) is an outline sectional view and (b) is the outline top view of the body of a sensor.
[Drawing 29] It is a main process sectional view for explaining the manufacture approach same as the above.
[Drawing 30] It is the outline top view of the body of a sensor same as the above.
[Drawing 31] It is the explanatory view of the manufacture approach same as the above.
[Drawing 32] It is the explanatory view of the manufacture approach same as the above.
[Description of Notations]
1 Body of Sensor
2 Covering
3 Covering
11 Housing
12 Weight Section
13 Bending Section
14 Slit
15 Gage Resistance
26 Chamfer
100' SOI substrate
101 Supporters

102 Embedded Insulating Layer
103 Barrier Layer

[Translation done.]

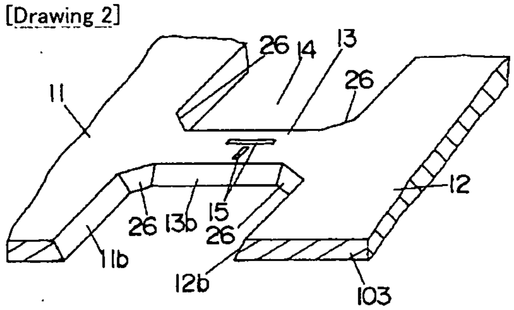
* NOTICES *

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

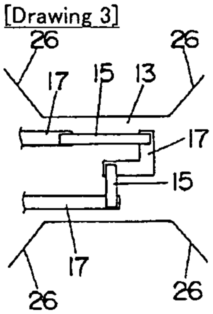
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 2]



[Drawing 3]



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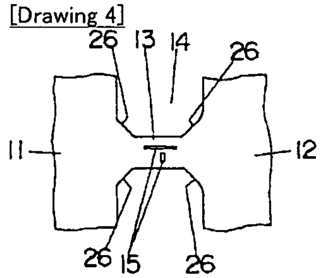
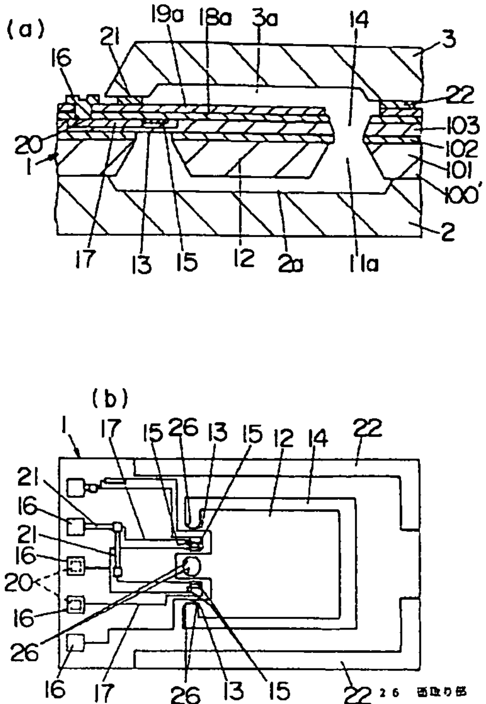
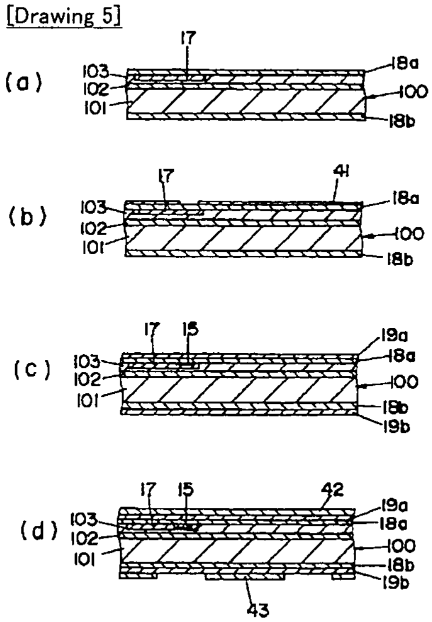


[Drawing 1]



26 面取り部
100' SOI基板
101 支持層
102 埋込絶縁層
103 活性層
11 支持体
12 重り部
13 撓み部
14 スリット
15 ゲージ抵抗
1 センサ本体
2 カバー
3 カバー

[Drawing 5]



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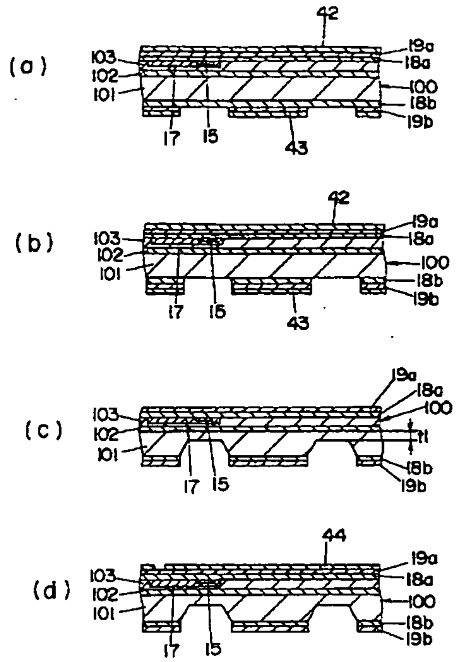
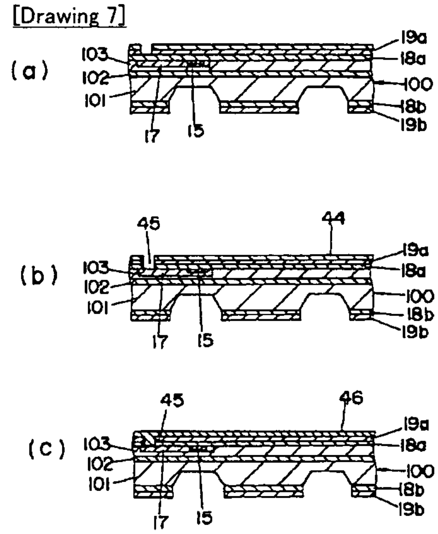
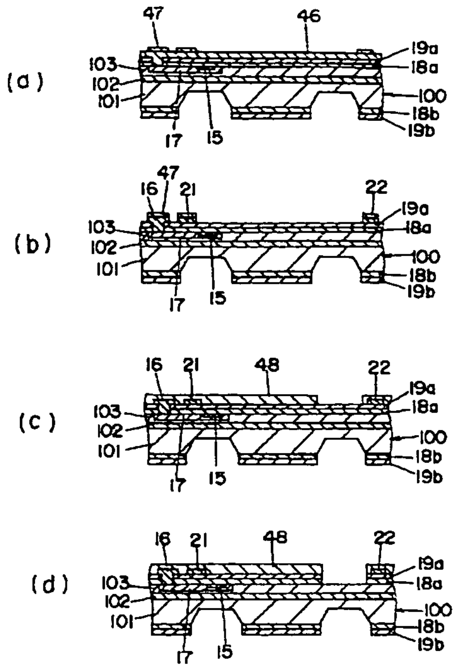


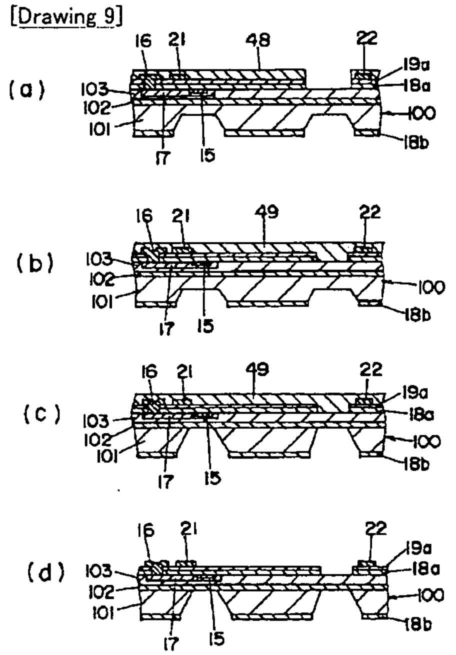
[Drawing 7]



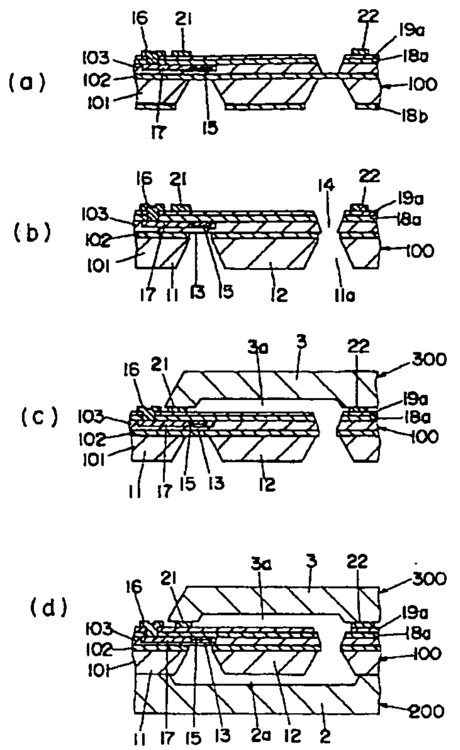
[Drawing 8]



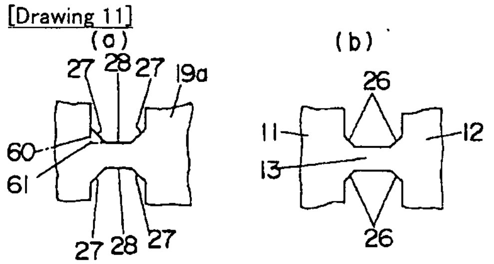
[Drawing 9]



[Drawing 10]



[Drawing 11]



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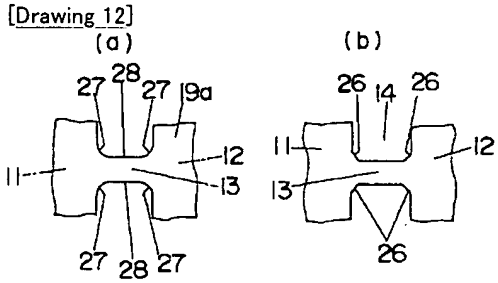
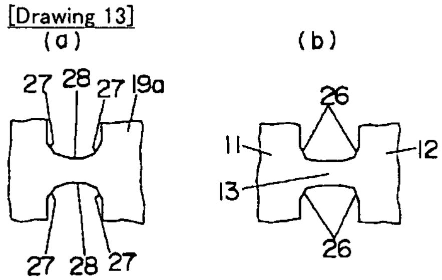
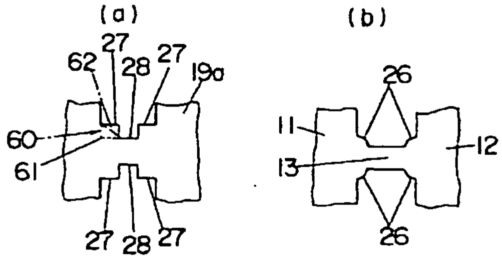


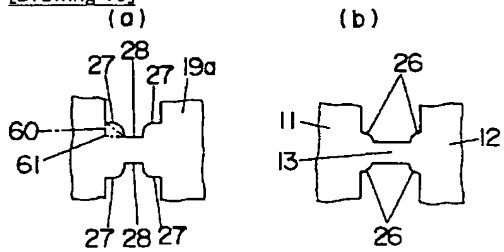
[Drawing 13]



[Drawing 14]



[Drawing 15]



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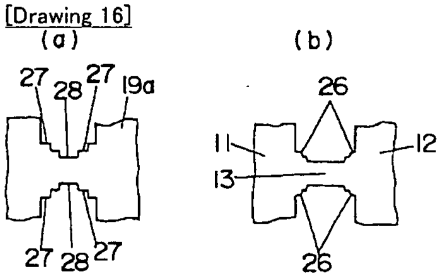
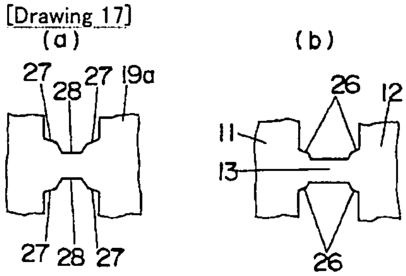
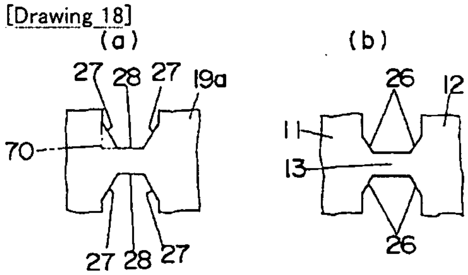


[Drawing 17]



[Drawing 18]



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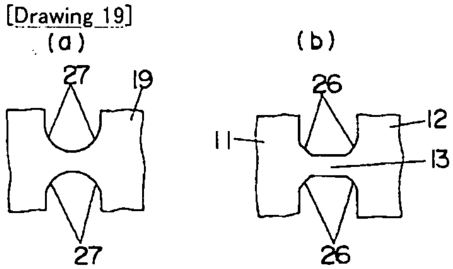

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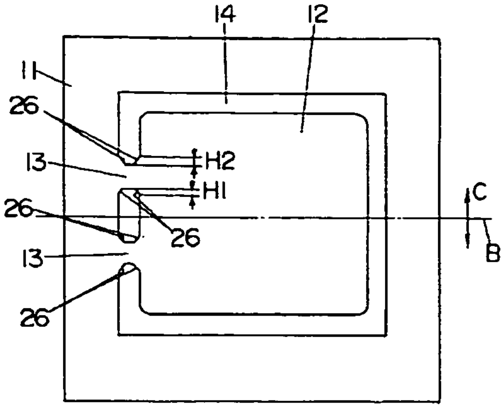

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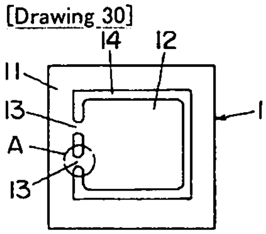
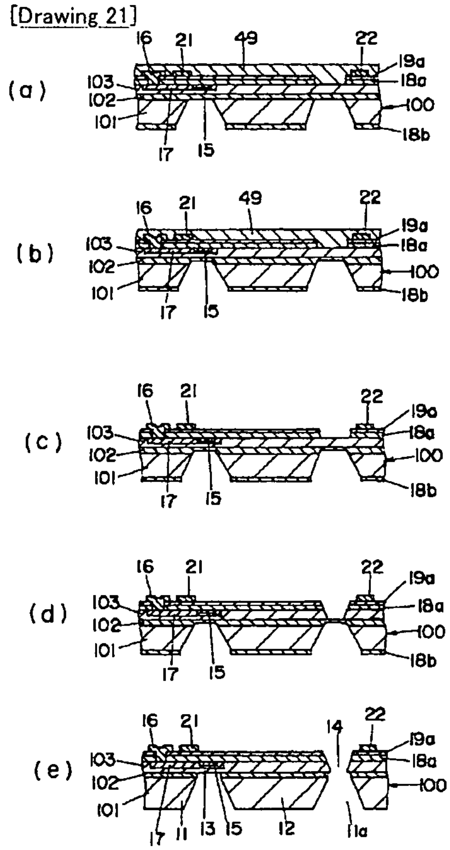
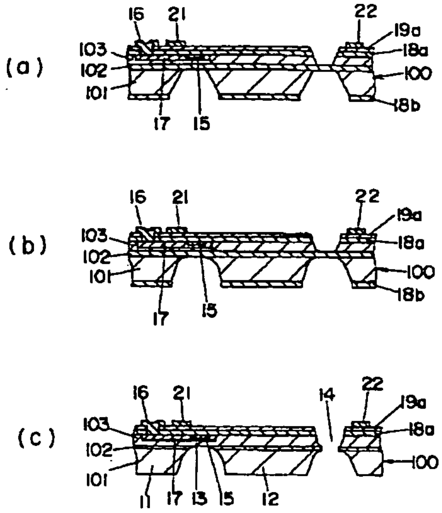


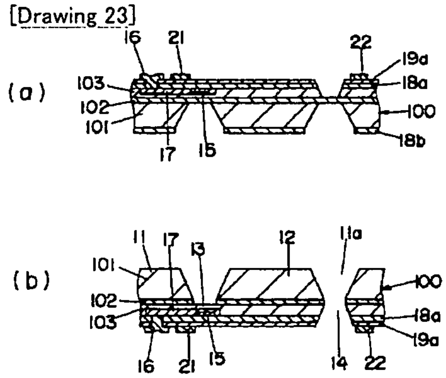
[Drawing 21]



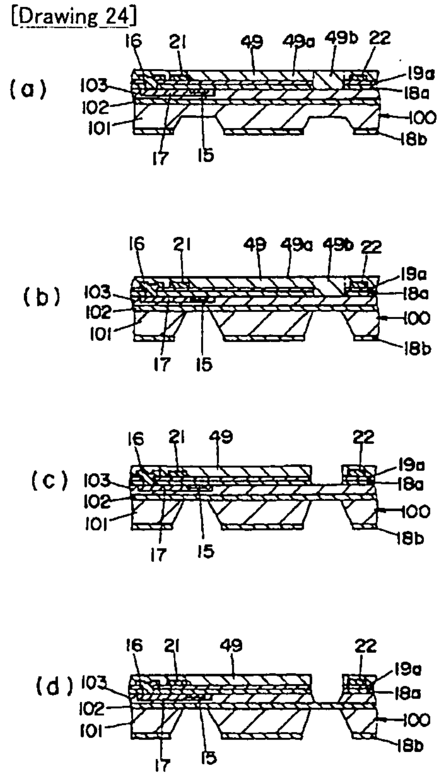
[Drawing 22]



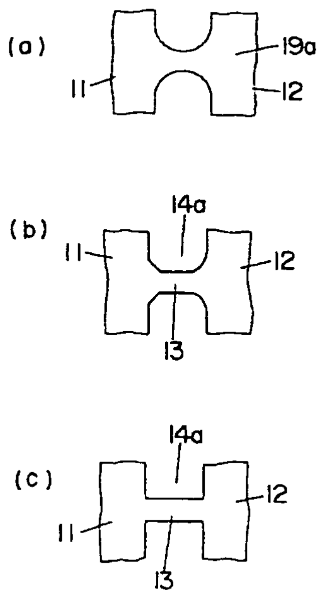
[Drawing 23]



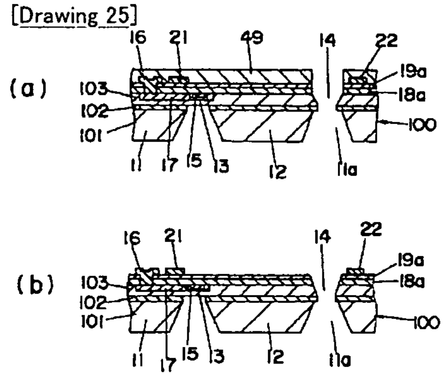
[Drawing 24]



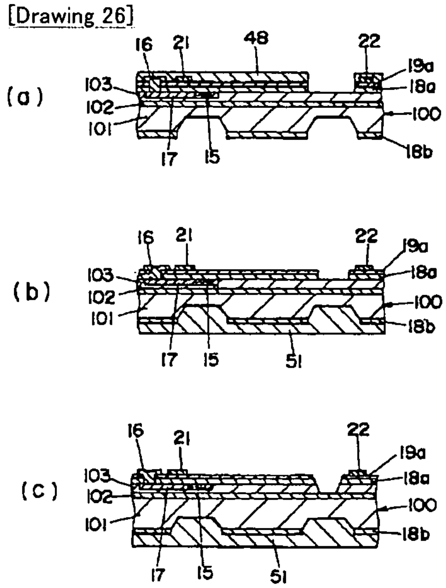
[Drawing 31]



[Drawing 25]

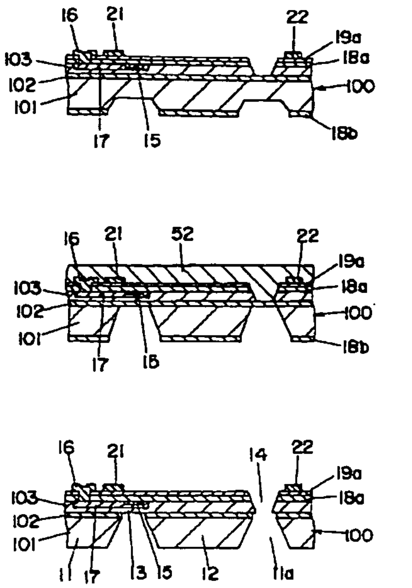


[Drawing 26]



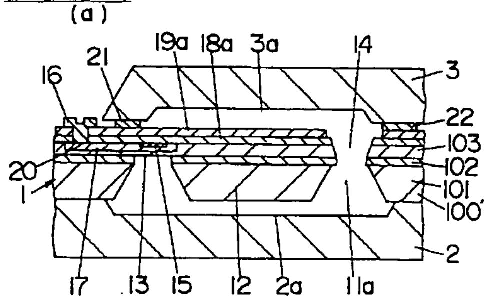
[Drawing 27]

(a) (b) (c)

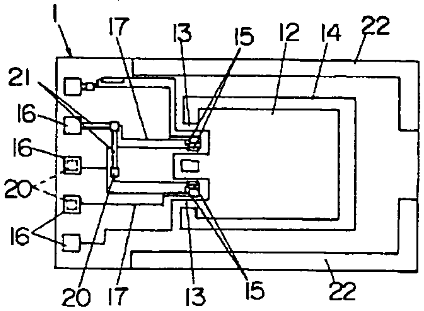


[Drawing 28]

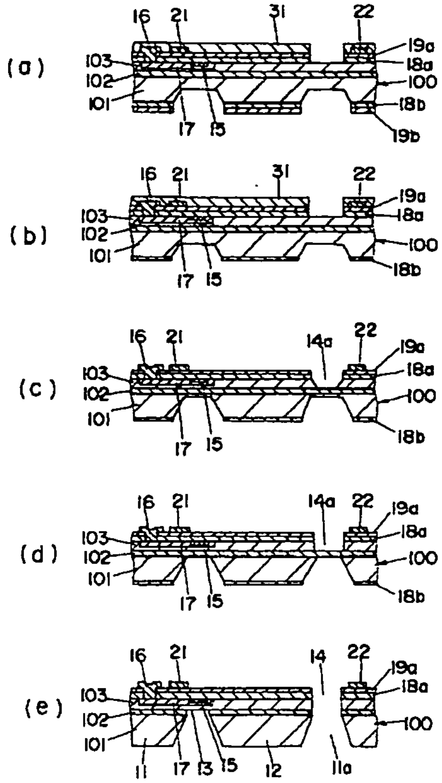
(a)



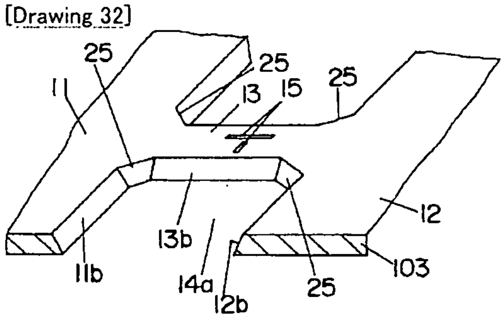
(b)



[Drawing 29]



[Drawing 32]



[Translation done.]